92-04805/

DECISION REPORT
Application #9101 - Chem Security (Alberta) Ltd.

Incinerator Expansion of the Swan Hills Special Waste Treatment Centre

April 1992

ALBERTA NRCB
NATURAL RESOURCES CONSERVATION BOARD

INCINERATOR EXPANSION OF THE SWAN HILLS SPECIAL WASTE TREATMENT CENTRE

NRCB Application 9101

April 1992

Published by:

Natural Resources Conservation Board
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Calgary, Alberta
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1. INTRODUCTION

1.1 Background

The Alberta Special Waste Treatment Centre (the Centre or Treatment Centre) is located approximately 12 kilometers (km) northeast of the Town of Swan Hills as shown in Appendix A. It was constructed during the years 1985 through 1987 to properly treat and dispose of hazardous and special waste produced in the Province of Alberta. The Centre is the most important element in the Alberta Special Waste Management System (the System or Waste Management System) which is responsible for the identification of special waste, its receipt and movement to the Centre, and its treatment and safe disposal. In addition to the Centre, the System is also responsible for the operation of transfer stations located at Calgary and Nisku.

The Waste Management System, including the Centre, is owned 60 percent by an Alberta company, Bovar Inc. (Bovar), and 40 percent by Alberta Special Waste Management Corporation (ASWMC), an Alberta Crown corporation. The System is operated by Chem-Security (Alberta) Ltd. (Chem-Security), a wholly owned subsidiary of Bovar.

The Centre was approved and constructed in its present location following extensive study and a public consultation process during the early 1980s. The Environment Council of Alberta conducted hearings and public information sessions and issued a report analyzing hazardous waste management options and issues. That report was the basis for the implementation of the current Waste Management System and the selection of the technology used at the Treatment Centre.

Locating the Centre at Swan Hills followed studies of regions which had suitable hydrogeologic, geographic and land use settings for a waste treatment facility. Following extensive public discussion, the residents of Swan Hills, through a plebiscite, supported locating the Centre near the Town.

The major responsibilities of the Treatment Centre include waste acceptance and related control, waste preparation and storage, incineration, physical and chemical treatment, stabilization of residues, deep well injection and maintenance of landfill cells. The rated capacity of the existing facility is 13,500 tonnes per year for incineration and 5,000 tonnes per year for physical and chemical treatment. Chem-Security has applied to expand the rated incineration capacity of the Centre by 40,000 tonnes per year.

1.2 Natural Resources Conservation Board (NRCB) Jurisdiction

The Natural Resources Conservation Board Act (the Act) established a Board "...to provide for an impartial process to review projects that will or may affect the natural resources of Alberta in order to determine whether, in the Board's opinion, the projects are in the public interest, having regard to the social and economic effects of the projects and the effect of the projects on the environment". The types of projects that are subject to review, as set out in the

Act, include any specific project prescribed by the Lieutenant Governor in Council. The Act further prohibits the commencement of a reviewable project unless the NRCB, on application, has granted an approval.

The Lieutenant Governor in Council, by Order-in-Council 377/91 dated June 6, 1991, prescribed "...the incinerator expansion at the Alberta Special Waste Treatment Centre at Swan Hills proposed by Chem-Security (Alberta) Ltd. as a reviewable project under ..." the Act. A copy of the Order-in-Council is attached to this report as Appendix B. As a result of the Order-in-Council, the Board has jurisdiction only to determine whether the proposed incinerator expansion is in the public interest. It does not have jurisdiction with respect to the currently existing Centre, nor with respect to other related matters, such as Government policy regarding special waste. Additionally it would not have jurisdiction to regulate the ongoing operations at the Treatment Centre.

1.3 The Hearing

A pre-hearing meeting was held in the Swan Hills Community Centre on July 3, 1991, to consider, among other matters, the location and timing of the hearing of the Chem-Security application. The pre-hearing meeting report is attached as Appendix C. Subject to meeting certain deadlines regarding the filing of the application and the response to any identified deficiencies, the public hearing was scheduled to commence in Swan Hills on November 12, 1991. The application was filed with the Board on July 15, 1991, and a response to a deficiency letter was filed on September 24, 1991. As a result of a request from a group of interveners for additional time to prepare, the hearing was re-scheduled to November 25, 1991.

The hearing convened in the Swan Hills Community Centre during the period November 25 to 28, 1991, with G. J. DeSorcy, P.Eng., G. A. Yarranton, Ph.D., and C. H. Weir, P.Eng., sitting as the Board. The hearing participants are listed in Table 1-1.

At the opening of the hearing on November 25, a spokesperson for the Indian First Nations requested that the hearing be further delayed as they required additional time to engage experts and prepare their submission. The applicant, Chem-Security, opposed the request.

The Board denied the request as considerable advance information respecting the application had been made available, the report of the July 3 pre-hearing meeting had been sent to the Indian Association of Alberta and Grand Council of Treaty 8, and Board staff had made considerable efforts to inform the native community. In denying the request, the Board encouraged the Indian First Nations to remain and participate in the hearing.

Prior to the conclusion of the hearing, another request for delay was made on behalf of the Indian First Nations. With the concurrence of the applicant, the Board adjourned the proceeding to January 27, 1992, to provide time for the Indian First Nations to prepare a submission.

On January 27, 1992, the Indian First Nations indicated that they had been unable to obtain legal and other expert assistance early enough to be in a position to proceed. A further adjournment of twelve weeks was requested. Chem-Security opposed the request for adjournment, pointing out that considerable effort had gone into communication with the public, including the native people, and that a two-month adjournment had already been granted.

The Board decided to grant a further adjournment, to March 26, 1992, notwithstanding that such a further adjournment could be considered by some as being unfair to the applicant. The conditions of the adjournment included a meeting on February 11, 1992, at which a status report was presented outlining the review of the application by the Indian First Nations and their request for intervener funding. The February 11 meeting is referred to further in section 1.4 and the report following the meeting is attached as Appendix D. The hearing continued on March 26 and 27 and concluded on March 28, 1992.

The granting of the second adjournment to the Indian First Nations was of sufficient importance that the Board provides further comment on the matter. As indicated at the hearing on January 27, the Board is of the view that the Notice of the Pre-Hearing Meeting, the July 3, 1991 meeting itself and the resulting report, the Preliminary Notice of Application, the Notice of Hearing, the commencement of the hearing in November and the granting of a two-month adjournment, when combined with efforts by Board staff to contact representatives of the native community, properly discharged the statutory responsibilities of the Board to provide notice to those parties who may be directly affected by the proposed project. In addition, the Board notes that Chem-Security had had extensive contact with native groups and held a number of meetings in their communities. Unfortunately, and notwithstanding the efforts that had been made, it was clear on January 27, that the Indian First Nations were not in a position to effectively participate in the hearing. This led to the further adjournment.

In assessing possible causes of this unfortunate situation, the Board recognizes that some of the early contacts by both Chem-Security and Board staff may have been with individuals or organizations that did not adequately pass the information on to the local level. Additionally, there appeared to be considerable misunderstanding as to whether or not a body such as the NRCB would hold public hearings, and if so, whether intervener funding would be available. The fact that the NRCB is a new organization which was conducting its first hearing, and that the expansion of the Treatment Centre was referred to the Board as opposed to being prescribed in the Act, may have contributed to the misunderstanding.

To avoid such situations in future, the Board will ensure that notices respecting proposed projects will be distributed widely at the local level. It will also make its staff available to explain the public review process whenever it appears that such actions would be beneficial. The Board expects a similar effort from future applicants, with particular emphasis on contacts at the local level.

With these efforts, and recognizing that the existence of the NRCB and its processes are already becoming more familiar, the Board does not expect similar problems to occur in future.

TABLE 1-1

HEARING PARTICIPANTS

Principals and Representatives (Abbreviations Used in Report)	Witnesses
Chem-Security (Alberta) Ltd. (Chem-Security)	
Mr. F. Saville, Q.C. Mr. R. A. Neufeld	Mr. A. Wakelin, P.Eng. Mr. G. Latonas Mr. J. Selby, P.Eng. Mr. P. Cutts (all of Chem-Security) Mr. D. Bromley, P.Eng. (David Bromley Engineering (1983) Ltd.) Dr. P. Tones (Sentar Consultants Ltd.) Mr. J. Olson, P.Geol. (Stanley Associates Engineering Ltd.) Mr. M. Schroeder (Western Research Ltd.) Dr. R. Willes (Cantox Ltd.) Dr. F. Bercha, P.Eng. (Bercha Group of Companies) Mr. D. Reid, P.Biol. (HBT AGRA Ltd.) Mr. D. Penner, P.Biol (Penner and Associates Ltd.) Dr. J. Berkowitz (Farkas Berkowitz & Company)
Town of Swan Hills	
Mayor W. Peters Dr. S. Hrudey Ms. D. Stevens	Mayor W. Peters

continued...

TABLE 1-1

HEARING PARTICIPANTS

Principals and Representatives (Abbreviations Used in Report)	Witnesses
Swan Hills Expansion Review Coalition (SHERC)	
Mr. R. Kruhlak Ms. S. Lobay	Mr. B. Staszenski (Environmental Resource Centre) Mr. K. Keulken (Fort Assiniboine District Environmental Action Association) Mr. M. Kitigawa (Toxic Watch Society) Mr. D. Howery (Applications Management Consulting Limited) Dr. J. Young, P.Eng. (Senes Consultants Ltd.)
Edmonton Friends of the North Environmental Society (EFONES)	
Ms. B. Hall Mr. N. Hanson Mr. R. Wilde	Ms. B. Hall Mr. N. Hanson Mr. R. Wilde
Alberta Trappers Association	
Mr. J. Rogers Mr. R. Wilde	Mr. J. Rogers

continued...

TABLE 1-1

HEARING PARTICIPANTS

Principals and Representatives (Abbreviations Used in Report)	Witnesses
Driftpile Indian First Nation, Swan River Indian First Nation, Sucker Creek Indian First Nation, Grouard Indian First Nation and the Indian Association of Alberta (Indian First Nations)	
Mr. J. Slavik Ms. N. McKenzie	Senator J. Willier Chief J. Badger Chief F. Halcrow Mr. D. Calliou Mr. L. Willier Mr. R. Davis Dr. D. Zalinger (Peat Marwick, Stevenson & Kellog) Dr. A. Hamilton (International Joint Commission)
Alberta Environment Staff	
Mr. R. Stone Dr. A. Seifried Dr. R. Huang	
Natural Resources Conservation Board Staff	
Mr. W. Kennedy Ms. J. Ingram Mr. P. Cleary Dr. R. Powell Dr. A. van Roodselaar Mr. J. McKee (all NRCB staff) Mr. M. Davies Mr. M. Zelensky (both of Concord Environmental Corporation)	

1.4 The Role of Alberta Environment

Alberta Environment participated in the hearing by asking questions of the applicant and interveners. It advised the Board, at the outset of the hearing, of its role respecting the applied for expansion. Alberta Environment is responsible for the administration of the Alberta Environmental Assessment Process. This process includes screening projects to determine the need for environmental assessment and directing an environmental impact assessment (EIA) where appropriate. It also includes establishing the terms of reference for an EIA and ensuring appropriate public input, co-ordinating the interdepartmental review of the EIA, and providing advice as to whether the EIA is suitable for discussion at a public hearing.

All of these functions were carried out with respect to the proposed expansion to the Swan Hills Special Waste Treatment Centre. On October 4, 1991, Alberta Environment advised the NRCB that the EIA for the expansion was suitable for discussion at a public hearing.

Alberta Environment also advised that the expansion of the Treatment Centre would require approval from Alberta Environment under the Clean Air Act and Clean Water Act, and that ongoing operation of the Centre would be regulated by Alberta Environment through those approvals. Applications had not been filed at the time of the opening of the hearing and Alberta Environment advised that it would not issue approvals until the NRCB had completed its review of the proposal and made its decision.

Alberta Environment also advised that it had, throughout the environmental assessment process, forwarded copies of the Environmental Impact Assessment and kept Environment Canada aware of the ongoing review.

1.5 Administrative Matters

A number of administrative matters were raised at the hearing and at the February 11, 1992 meeting which, although related in some manner to the subject proceeding, would not likely be a major consideration in determining whether the proposed expansion would be in the public interest of Albertans. Nevertheless, as the Board is a new organization it wishes to comment on the following matters in order to clarify the manner in which the Board will function.

1.5.1 Responsibilities of the Applicant

Although ASWMC, through a Joint Venture Agreement, owns 40 percent of the Alberta Special Waste Management System, it did not appear at the hearing. Several participants questioned "...what part they (the Crown) played in fulfilling the obligations and responsibilities with respect to ..." the application. At the February 11 meeting, the Indian First Nations asked the Board to direct that ASWMC and the Joint Venture of ASWMC and Bovar be joined with

Chem-Security as applicant. The Indian First Nations further requested that the Board direct the Honourable R. Klein, Minister of the Environment, or a senior representative on his behalf, and Mr. R. Clark, Chairman, or some other member of the Board of ASWMC, to appear at the hearing.

Chem-Security is the operator of the Treatment Centre pursuant to a contractual arrangement with the owners. It submitted an application to the NRCB in its capacity as the operator of the Centre. This practice is common in situations where a facility is owned by a number of parties, is operated by an entity on the basis of a contractual arrangement, and applications must be made for approvals or licences. In this situation, the Board considers that Chem-Security is making the application on behalf of the owners of the Centre, and that the commitments provided by Chem-Security in the application and at the hearing are given on behalf of the owners, Bovar and ASWMC. It is the Board's view that the responsibility for the performance of those commitments and the proper operation of the Centre flows through to the owners via the Joint Venture Agreement for the construction and operation of the Centre. The Board, therefore, decided not to make the direction that the owners of the Centre be joined as applicant.

With respect to the request that Mr. Klein, Mr. Clark, or other senior officials appear at the hearing, the Board does not believe that their presence is necessary to provide the information that the Board needs to make a full review of the application before it. In this regard, it is important to note that the Board's jurisdiction relates only to the proposed incinerator expansion at the Centre, and not to matters such as past and current operations at the Centre nor Government waste management policies. Therefore, the Board did not direct the appearance of the additional parties at the hearing as requested by the Indian First Nations.

1.5.2 Intervener Costs

At least one intervener at the hearing appeared to be of the impression that the Board "...did not make a ruling in our favour..." with respect to intervener costs and that it left interveners to deal directly with the applicant, Chem-Security. The Board provides the following clarification of the situation.

The NRCB Act provides that parties "...who, in the opinion of the Board, are or may be directly affected by a reviewable project..." may apply for funding to participate in Board proceedings. The costs awarded would normally be paid to the intervener by the applicant (for the project). The Act further provides that the Board may "...make an award of costs..." to eligible interveners after a proceeding, and also direct advances of costs earlier in the process where reasonable to do so.

The Board expects that interveners who are applying for funding, whether for a cost award after a hearing or for an advance of costs, to first address the issue of eligibility as an individual or group of individuals directly affected, and then to deal with the issue of reasonable costs. The Board is always prepared, as required by the Act, to consider and rule on requests

for costs. At the same time, it recognizes that there are advantages to be gained when the applicant and intervener discuss the matter of costs and reach a voluntary agreement. The Board encourages such an approach, but as indicated previously, is prepared to deal with cost applications at any time, if necessary.

With regard to this application, Chem-Security and SHERC followed the voluntary funding process and reached an agreement with respect to costs. Unfortunately, some of the participants in the hearing were of the impression that the voluntary arrangement was necessitated because the Board had refused a request by SHERC for costs. In fact, at the commencement of the hearing, no cost applications had been received by the Board.

The Board subsequently received applications for costs from EFONES and for an advance of funds from the Indian First Nations, and it may receive other cost related applications. The Board does not believe that such cost matters should be part of its decision on the proposed project, and has dealt or will deal with the cost applications in the normal manner.

2. THE APPLICATION

2.1 Application

Chem-Security applied to the NRCB for approval to expand the Swan Hills Waste Treatment Centre. The application consisted of five volumes which include a three-volume EIA submitted in accordance with the Land Surface Conservation and Reclamation Act, a volume containing the application to the NRCB, and a volume containing Chem-Security's responses to the Board's Request for Supplemental Information. An assessment report of hazardous waste volumes, prepared by David Bromley Engineering (1983) Ltd., titled "Hazardous Waste Volumes and Residual Wastes in the Province of Alberta" (October 1991) (The Bromley Report), was also submitted prior to the public hearing of the application. Further evidence was provided by the applicant at the hearing in response to concerns raised by interveners, Alberta Environment and the Board.

The evidence before the Board is related to the present operation of the Treatment Centre and the need for the proposed expansion, considering present and potential waste volumes, market opportunities and economics. As well, the evidence assesses transportation of waste and the potential impacts of the proposed project on the environment, land use, historical resources, nearby communities, human health, and the regional economy.

The application, intervener submissions, all exhibits tendered during the hearing and the hearing transcripts are available for public viewing at the Board's office.

2.2 Proposed System Description

The application before the Board is a proposal to install a rotary kiln with a nominal capacity of 40,000 tonnes per year to augment the present twin rocking and rotary kilns which have a total nominal capacity of 13,500 tonnes per year. The expansion project would also involve changes to the associated waste feed system and auxiliary utility, support and monitoring systems. It would include a number of modifications to the existing plant, including expansion of the solid waste storage area, extension of an existing stack and the possible removal of a cooling tower associated with the existing rocking kilns.

The proposed expansion would be capable of simultaneous processing of liquids, sludges and solids from a wide variety of waste streams. Chem-Security advises that it is designed to achieve a minimum destruction and removal efficiency (DRE) of 99.9999 percent for designated organic compounds such as polychlorinated biphenyls (PCBs). To reach this objective, Chem-Security stated it has chosen proven incineration and pollution control technologies.

The system proposed by Chem-Security would consist of a waste feed system, a primary kiln, a secondary combustion chamber, a multi-stage flue gas cleaning system and a slag quench tank and conveyor assembly to deal with slag and ash. Solid waste in bulk or drums would be placed in a feed hopper by crane or drum conveyor. Liquid and pumpable sludge waste would be fed into the primary kiln through lances. The proposed kiln is a refractory-lined 12.2 meter (m) steel cylinder with an inside diameter of 4 m tapered to a smaller diameter at both ends. Primary combustion of waste material would take place in the rotary kiln at a temperature of approximately 1,000°C. The residence times for waste would be adjusted by the operator according to the composition of the waste stream. Gases existing in the kiln would be fed through a secondary combustion chamber maintaining a temperature of 1,200°C to ensure nearly complete destruction of organic compounds. The flue gas cleaning system would consist of a spray dryer, electrostatic precipitator, quench, packed bed wet scrubbers and venturi scrubbers. The system is designed to remove acid gases and particulates. Emissions would be released from a 45.7 m stack equipped with a continuous emission monitoring (CEM) system and sampling ports for intermittent monitoring. Solid waste residues from incineration (slag and flyash) and waste materials deemed unsuitable for incineration would be stabilized and placed in a secure landfill.

2.3 Issues Related to the Proposed Expansion

The construction and operation of the proposed expansion involves social and economic impacts as well as risks to human health and the environment. According to the application, it is intended to fulfill a social need by providing an environmentally acceptable method of disposing of special waste. The applicant provided evidence in the application and at the hearing to support its claims that the proposed project is justified, the impacts and risks are acceptable, and all reasonable steps would be taken to minimize risks and mitigate any negative impacts which cannot be avoided altogether. Some of the assertions made by the applicant were challenged by interveners at the hearing and a brief description of their positions is provided in section 3.

3. POSITIONS OF THE INTERVENERS

3.1 Town of Swan Hills

Mayor Peters indicated that the Town of Swan Hills supports the application by Chem-Security to expand the Treatment Centre. The people of Swan Hills participated in the preparation of the EIA. The Town was involved in the public consultation process dealing with the original siting of the Centre and has continued to be involved throughout the initial construction and operating phases. Chem-Security, as operator of the Centre, provides the Town with all relevant reports and documents respecting monitoring and safety of operations. Concerns are addressed either directly by Council or through the Citizens Liaison Committee. The Town expressed confidence that the good working relationship it had with the operator would continue in the future.

The Town indicated satisfaction with the degree of regulation and monitoring provided by Government. It also utilizes the assistance of an independent environmental consultant. The Town considers that the province is fortunate to have the Treatment Centre which has proven to be valuable in reducing special waste. It also considers that the Centre provides industrial diversification for the province and is an economic benefit to the Town.

3.2 Swan Hills Expansion Review Coalition (SHERC)

SHERC is comprised of a number of environmental groups that have concerns regarding the proposed expansion of the Alberta Special Waste Treatment Centre. The groups formed a coalition with the objective of organizing and presenting an effective and efficient intervention. They are:

- Pembina Institute for Appropriate Development (PIAD);
- Pembina Agricultural Protection Association (PAPA);
- Fort Assiniboine District Environmental Action Association (FADEAA);
- Save Tomorrow Oppose Pollution (STOP) -- Environmental Resource Centre;
- Toxic Watch Society of Alberta (TWS); and
- Canadian Parks and Wilderness Society, Alberta Chapter (CPAWS).

SHERC emphasized that it was not speaking on behalf of environmental groups or individuals who are concerned with the environment, other than those identified above. Some of its member groups had been involved in the public consultation process respecting the initial site selection for the Centre, as well as the planning for the expansion. This included participation in the Public Consultation Steering Committee, attendance at many public meetings, and more recently, meetings between Chem-Security, members of SHERC and their consultants.

SHERC, with the assistance of outside consultants, reviewed the Chem-Security application with emphasis on the economics of the project from the perspective of the public, its impacts on air and water quality, and the transportation risk assessment. With respect to the economics of the project, SHERC was concerned that the proposed expansion of the Centre by 40,000 tonnes per year would result in excess capacity. This excess capacity could in turn create a disincentive to reduce waste produced by generators across the province. SHERC was also concerned that the excess capacity could also serve as an incentive to import waste from outside Alberta.

SHERC expressed concern that the incineration of additional toxic waste at the Centre would raise local levels of various contaminants and also push toxics further along eco-systemic pathways. It consequently emphasized the need for proper monitoring. It expressed concern regarding the shipment of large volumes of special waste to the Centre, suggesting that the increased truck traffic would increase the risk of an accident which could affect the public and the environment. Specific concern was raised respecting highway 33, a major route for the movement of waste which runs through the Fort Assiniboine District.

SHERC made the following specific recommendations respecting the application:

- better definition of available waste volumes is necessary to avoid the creation of unnecessary over-capacity;
- a Demand Side Management Plan should be developed by the applicant to assist in reducing waste production at the source;
- an assessment should be undertaken of the possible health hazards posed by dust from contaminated soils near the Centre;
- pollution control equipment should be in place to ensure that emission standards are never exceeded, even during emergency venting;
- an assessment should be made of the impact of long-term increases in ambient temperatures on incinerator operations;
- appropriate monitoring should be performed for level of concern 1 compounds;
- investigation of the apparent difference in atmospheric stability estimates at the Centre and at the Town of Edson should be conducted;
- the monitoring for PCBs should be expanded to include more carnivores;

- the philosophy of the monitoring program should place the focus on testing the applicant's assumptions concerning the transport and ultimate fate of atmospheric emissions;

- a system of service auditing should be implemented; and

- a transportation consequence analysis and development of an emergency response plan should be undertaken to deal with possible accidental spills.

SHERC also suggested that methylation/demethylation rates in lakes in the area should be recorded to establish baseline rates, and that monitoring of the landfill sites should continue indefinitely.

3.3 Edmonton Friends of the North Environmental Society (EFONES)

EFONES is an Edmonton based organization of volunteers which reviews environmental concerns. It raised a number of issues respecting the proposed expansion of the Treatment Centre and the procedures of the NRCB.

EFONES expressed concern that hearings were not held in Edmonton and elsewhere in the province, suggesting that few persons from the immediate area appeared at the hearing. It also questioned why the Government was not appearing as an applicant since the Crown Corporation, ASWMC, would provide 40 percent of the funding. Additionally, EFONES expressed concern that the Joint Venture Agreement places too much financial risk on the public and that the proposed capacity of the expansion could encourage the importation of waste.

In its presentation and through questions and closing statement, EFONES raised the following additional issues:

- the need to reduce the production of waste;
- alternative waste treatment technologies being used elsewhere in the world;
- the possibility that clay based landfill units may fail and the necessity to keep them dry forever if they are to be safe; and
- the concept that special wastes are poisonous and that this should not be discounted by Chem-Security in its design and operation of the Centre.

EFONES took the position that the expansion application should not be approved, in part because of concerns regarding the ongoing liabilities of the Centre. It stated that its attitude could be best summarized by reference to the following statement taken from the report of The Rawson Academy of Aquatic Science submitted by SHERC: "... given the essential unpredictability of the fate of materials released to the atmosphere and the use of unproven landfill technology, this is an open-ended commitment whose ultimate cost cannot be known".

3.4 Alberta Trappers Association

Mr. Jim Rogers, on behalf of the Alberta Trappers Association, raised a number of concerns. The health and safety of the public was the number one concern.

The Trappers Association expressed concern regarding the financial arrangements between the Government of Alberta and operators of the plant and the ongoing liability and responsibility for problems. It suggested that the Government was supporting the project through subsidies and cost plus arrangements, but that the hearing process and availability of funding did not allow appropriate involvement by the Alberta public.

Concerns were also raised respecting possible harmful effects from dust emissions, insufficient examination of effects on trees in the area, and the lack of baseline studies on wildlife and animals. Mr. Rogers referred to a site visit and expressed concern regarding certain practices he had observed.

The Trappers Association was not satisfied with the projected volumes of waste and expressed concern that additional waste might be imported from out of province for treatment at the Centre. It took the position that the projection of waste volumes and all other aspects of the assessment of the proposed expansion should have been carried out by a third party.

3.5 Driftpile Indian First Nation, Swan River Indian First Nation, Sucker Creek Indian First Nation, Grouard Indian First Nation, and the Indian Association of Alberta (Indian First Nations)

The Indian First Nations opposed approval of the expansion and indeed took the position that the existing facility should be shut down. The principal reasons given in support of its position are summarized as follows:

- Chem-Security has failed to jointly prepare and implement, in cooperation with aboriginal people, an adequate biological-effects monitoring program;
- Chem-Security has not provided adequate detail to verify its forecasts of available waste;
- Chem-Security has failed to establish that the economic effects of the proposed expansion would be in the public interest;
- Chem-Security has failed to establish that there is a need and demand for the size of the proposed expansion;
- the proposed regulations on which the waste volume forecasts were based, have not been enacted and therefore the forecasts are highly speculative;

- the applicant has not developed an adequate Demand Side Management Plan which would ensure the ongoing minimization of wastes requiring treatment;

- Chem-Security does not have an employment program which would appropriately involve aboriginal people; and

- Chem-Security has not provided adequate assurance that waste would not be imported as a result of constructing too large a facility.

The Indian First Nations stated that if the project was approved, the following conditions should apply:

- the scope of the monitoring program should be expanded and potentially impacted persons, including representatives of the Indian First Nations, should participate in the monitoring program;

- Chem-Security, the Joint Venture and ASWMC should develop an appropriate Demand Side Management Plan which would promote reduction of waste; and

- Chem-Security should be required to ensure any socio-economic benefits from the Centre benefit both aboriginal and non-aboriginal people.

4. BASIS OF DECISION

The Board is directed by the NRCB Act to review the subject application to determine whether, in the Board's opinion, the proposed expansion of the Swan Hills Special Waste Treatment Centre is in the public interest, having regard to the social and economic effects of the proposed expansion and its effect on the environment. In assessing the various impacts, the Board must have regard for the existing or background circumstances so that the effects of all impacts may be considered on a cumulative basis.

In considering the public interest, there are a number of issues which are not singularly social, economic or environmental matters, but which cut across and affect each of these categories. For example, even minimal negative social and environmental effects might not be acceptable, and positive economic effects would not likely occur, if there was not justification or need for the proposed expansion, if the expansion was not economically viable or the applicant did not have the technical or financial capability to carry it out. Accordingly, the Board believes that the first issues it should consider in assessing the application are:

- justification for the proposed expansion; and
- selection of technology and viability of the proposed expansion.

If it concluded that there is justification for the expansion and that it is viable, the Board, having due regard for the input received from the participants in the hearing, believes it should then go on to assess in detail the effects that would likely result and the mitigative measures that may be taken to reduce any negative effects. In doing so, it would deal specifically with the following issues:

- emissions from the plant to the atmosphere;
- disposal of solid waste at the Centre;
- disposal of liquid waste at the Centre;
- transportation of wastes to the Centre;
- socio-economic effects of the proposed expansion;
- public involvement; and
- other matters.

The Board, in making its decision, believes it should bring together its conclusions respecting the various effects that would result from the proposal, some of which would be negative and some of which would be positive. The Board must balance these effects and on that basis, form an overall opinion as to whether or not the proposed expansion is in the public interest.

Evidence and information respecting the present facility was submitted to the Board. The purpose of this information was not for the Board to conduct a review of the present operation of the Centre, but to assist the Board in the assessment of the impacts that could be expected from the expansion proposal should approval be given.

5. JUSTIFICATION FOR THE PROPOSED EXPANSION

5.1 Justification and Capacity

5.1.1 Views of the Participants

Two projections of waste volumes that may be available to an expanded Treatment Centre were presented by the applicant to demonstrate the need for the proposed expansion.

The first projection was contained in the EIA and was based upon the applicant's knowledge relating to historical demand, current waste inventory, individual waste generators and their disposal requirements, and individual projects such as site decommissioning or remediation. This information was gained as a result of interviews by Chem-Security personnel with waste generators who presently utilize the incineration facility at Swan Hills for waste treatment. The substance of the interviews was represented as being confidential in nature and hence was not open to scrutiny by the Board. It was stated that these confidential interviews took place with 94 out of 524 clients who produce the largest volumes of waste currently received by the applicant: "I think in our case, we are seeing that 20 percent of the generators are responsible for 90 and 95 percent of the waste. This is what we see in other jurisdictions as well." Generators who "have or are expected to produce less than 50 [tonnes per year] of waste were not individually included in the data base."

As a result of the 94 clients interviewed, the applicant estimated that approximately 24,900 tonnes of waste would be available for disposal in 1991. Chem-Security assumed that waste volumes would increase at a rate of 5 percent each year into the foreseeable future as a result of "pressures of industrial growth, regulatory enforcement, and ever-increasing environmental awareness ... despite waste minimization initiatives."

Chem-Security also made an estimate of the volume of waste which would be available to the Centre from waste produced in the past and stored at various locations throughout the province. Based on its interviews with clients, Chem-Security estimated that some 90,000 tonnes of waste were identified as in storage, of which some 40,000 tonnes were expected to go to the Swan Hills Centre for treatment.

The second projection, one which the applicant considered as being complimentary to the first, was contained in a report prepared by Mr. Bromley.

Mr. Bromley stated that the data and information used to estimate waste volumes in his report were gained as a result of the analysis of previous reports and studies regarding waste volumes, interviews with waste management personnel working in the industrial sector and field related data. The Bromley Report also dealt with two categories of hazardous waste, waste produced from "ongoing" industrial operations, and waste from "inventory" stored at various locations throughout the province.

The Bromley Report was based on the following assumptions:

- there would be no growth or decline in the industrial sector over the next ten years;
- only the past ten years of plant operation contributed to the waste in inventory;
- source reduction of waste is difficult for the oil and gas sector because many of the waste constituents occur naturally in the produced raw material;
- by the year 2002, a well defined waste minimization and waste management strategy would be in effect;
- waste minimization will occur through a variety of source reduction, recycle, recovery and reuse technologies. These technologies would result in a 50 percent source reduction for a number of waste types;
- there would be a general trend away from land application type technologies but there would be an improvement in the efficiency and capability of bio-remediation and soil washing technologies; and
- reclassification of waste from non-hazardous to hazardous will occur, but at a modest rate. As a result, the hazardous waste percentage components for some wastes were increased by 50 percent, but for others not at all.

The Bromley Report estimated waste volumes that would be available to an expanded Treatment Centre for a period of ten years into the future. The rationale for this time limitation related to the difficulty in predicting technical and regulatory changes beyond that period. The waste volumes from ongoing operations as estimated by Mr. Bromley ranged from a current level of 47,435 tonnes per year to 37, 486 tonnes per year in the year 2002. The corresponding range for waste from inventory was from 32,455 tonnes per year to 24,757 tonnes per year. The reduction in waste from both ongoing operations and inventory was due to waste minimization efforts. Combining the waste estimated to be available from ongoing operations and inventories results in current volumes of 79,890 tonnes per year, declining to 62,243 tonnes annually by the year 2002.

In addition to the above information on waste volumes, the applicant indicated that part of the justification of an expanded facility was created by a shift in the heat value of waste streams. An incinerator is designed to release heat from waste in a controlled manner. The technical design of the incinerator which is the subject of this application is for a nominal capacity of 40,000 tonnes per year of waste with a heating value of approximately 8,000 BTU's per pound. As the BTU content of incinerated material increases, the time required to destroy the material also increases and the result is a lower yearly throughput of waste. The applicant stated that "...one of the reasons that we in fact need an expansion, is there has been quite a significant shift in the composition of the waste streams within the province, whereas earlier they

were primarily liquids. That was the ones that the generators wanted to move. Now, it is moving increasingly to solids and sludge. That is the trend we expect to continue."

In response to concerns that the proposed expansion might be over-sized, the applicant suggested that the capital and operating costs for a smaller expansion would not be reduced in a manner proportionate to the reduced capacity. To illustrate, Chem-Security estimated that the capital cost of 30,000 and 20,000 tonnes per year expansions would be about $53 million and $48 million, respectively. The proposed 40,000 tonnes per year expansion is estimated to cost $60 million. Chem-Security also said that an expansion carried out in two stages, for example two units of 20,000 tonnes each, would involve significantly higher capital and operating costs.

Chem-Security emphasized that the existing operation "... cannot handle the volume of the waste that exists in today's market." The applicant, therefore, requested that the Board approve an incineration capacity expansion of 40,000 tonnes per year. Having requested an expansion of this magnitude, the applicant recognized that there was some risk of over-capacity of the facility. The applicant stated that if it gets into a situation of over-capacity, it would primarily utilize the expansion unit rather than the existing incinerator because the new unit would be more effective and efficient.

Among the issues addressed by SHERC was the question of whether or not an incinerator expansion was necessary and, if so, what might be the appropriate size of an expanded facility. Both of these questions were of concern to other interveners.

The conclusion of SHERC was the subject of the first recommendation cited in its written submission to the Board:

> "The volume of hazardous waste which could reasonably be expected to be handled by the Swan Hills facility be better defined to determine the appropriate size of expansion which would not result in the creation of unnecessary over-capacity and the risks associated with such excess capacity."

SHERC, the Indian First Nations, and other interveners were concerned that excess capacity would represent a significant financial risk to the publicly supported project and would function as an incentive for the applicant to import waste from outside of Alberta. Also, it was argued that excess capacity would function as a disincentive to reusing, recycling and reduction of the amount of waste being generated.

In support of its conclusion, SHERC relied upon the analysis of the application undertaken by Mr. Howery. His review included the material submitted to the Board by the applicant as well as four other waste surveys conducted within the Province of Alberta between 1980 and 1989. Upon a review of the waste surveys, SHERC concluded that considerable uncertainty exists regarding the waste volumes requiring treatment at a facility such as the Treatment Centre.

Mr. Howery, on behalf of SHERC, presented a sensitivity analysis conducted on the Chem-Security data to emphasize the uncertainty regarding waste volumes. He also said that "... other sensitivity analyses could be conducted and should be conducted which would represent reasonable adjustments to the base assumptions which have been incorporated in the numbers and this could further expand the range of variability (of the data)." This mathematical uncertainty was further highlighted by Mr. Howery's recognition that waste generators may not disclose all of the waste being produced and that waste producers may not have an accurate understanding of the waste produced themselves: "They may be overestimating it; they may be underestimating it." Notwithstanding the concern respecting uncertainties, SHERC appeared to agree that the best current information available before the Board was contained in the EIA and the Bromley Report.

SHERC also noted uncertainties regarding a lack of detailed estimates for heat values of potential waste streams. It also questioned the capital cost estimates of Chem-Security for smaller expansions of 30,000 or 20,000 tonnes per year, pointing to the recent addition of an 8,000 tonnes per year incinerator for a "... capital investment cost of approximately $9.5 million."

In their submission, the Indian First Nations took a position similar to SHERC. However, rather than focusing upon the issue of market uncertainty, the Indian First Nations argued that the Chem-Security and the Bromley waste volume projections were flawed because the methods used to arrive at waste volume projections were not derived from a scientific, "transparent", statistical model wherein data were systematically collected and hence subject to verification and replication by an independent authority.

In order to support their position, the Indian First Nations relied upon the expertise of Dr. D. Zalinger. After having reviewed both the Chem-Security and Bromley waste market projections, Dr. Zalinger concluded these studies are unreliable and therefore should not be relied upon for the Board's decision making process. However, upon further questioning as to a circumstance whereby 94 clients who were thought to be "most important" out of 524 were interviewed for the purpose of obtaining waste volume estimates, Dr. Zalinger said that if he were to be satisfied with the interview procedures: "...I think certainly from a statistical perspective, we would have very, very reliable estimates of the top 100." Further, Dr. Zalinger concluded that within this circumstance it would be reasonable to conclude that the amount of waste available would be greater than 25,000 tonnes per year.

Dr. Zalinger also noted, in response to questions, that the forecasting method used by himself has not been generally applied in other jurisdictions for the purpose of waste market analysis.

In rebuttal to the Indian First Nation's submission, Dr. J. Berkowitz, an expert in waste management practice in the U.S.A., stated that the most relevant information in estimating waste volumes comes from the generators: "Surveys have their place, if you have no other information. Their major use is really to guide you in asking questions of the interviewees; but

our experience is that to get good marketing data, you really have to talk to the generator..." Further, Dr. Berkowitz advised that, based upon her experience, "...the quantity and quality of data that have been put before the Board in this application are well above average for market surveys for a hazardous waste disposal facility..." Dr. Berkowitz stated that there would be very little value in further study as "...actual waste receipts never correspond to the expectations based on market surveys."

In response to the concerns raised by interveners, particularly SHERC and the Indian First Nations, the applicant referred to statements contained in a "Licence Application and Environmental Impact Assessment For Manitoba's Central Hazardous Waste Management Facility...". According to Chem-Security the document refers to the imprecise nature of waste market forecasts resulting from a tendency for waste volumes to change as a result of regulations and enforcement, the variability of waste streams available to a facility, changing economic conditions and "the demand for products and services and society's values generally". More specifically, the "Licence Application" was referred to in support of the need for confidentiality of information obtained from waste market surveys wherein it is stated that, "...waste characterization information ... was obtained from a confidential survey of individual waste generators."

In addition to matters related to the justification of the proposed expansion of the Swan Hills incinerator, several interveners expressed concerns regarding the nature of legislation providing for the establishment of the Alberta Special Waste Management Corporation, the content of the Joint Venture Agreement between the various parties concerned with the Swan Hills Waste Treatment Centre, and the policies of the Alberta Government respecting special waste.

5.1.2 Views of the Board

Prior to dealing with the issues of potentially available waste volumes and the justification for an expansion, the Board believes it should address the broader issues of the Joint Venture Agreement and the special waste policies of the Alberta Government. As indicated in its report following the July 3, 1991 meeting and several times since then, the Board does not have jurisdiction to review the existing Swan Hills facility, the waste management policies of the Government, or the agreements respecting the operations of the Waste Management System or Treatment Centre. The Board's jurisdiction relates only to the determination of whether the proposed expansion of the Centre would be in the public interest of Albertans.

As the Board sees the situation, the policy established by the Government, following consultation with the public and recommendations by the Environment Council of Alberta, is to ensure that a treatment facility is available to dispose of special waste generated in the province in a manner that protects the health and safety of Albertans. The policy further provides for the maximum practical involvement of the private sector to ensure efficient operation and maintenance of the treatment facility. Additionally, it is Government policy to set waste treatment prices which reflect the prices available elsewhere in North America and which are

high enough to reflect the concept of user pay, but not so high as to discourage waste generators from using the facility. This is because if waste does not go to the facility, it may be stored where generated or improperly disposed of in a less suitable manner. This would likely involve costs to Albertans.

If the policy to ensure that treatment capacity is available, coupled with the pricing policy, should result in a shortfall in revenue to operate the Centre, the Government policy further provides that the shortfall would be made up from public funds.

As indicated previously, the Board is not conducting a review of the policy, but is evaluating the proposed expansion in the light of the existence of the policy.

The Board has reviewed, in considerable detail, all of the information submitted with respect to the forecasted volumes of waste which may be available to an expanded Treatment Centre. Such a forecast is difficult to make because it involves many generators of waste, in many different sectors, throughout the province. The total volume of produced waste must first be estimated, and is very large. That portion which is hazardous and requires special treatment must then be estimated. Finally, the forecast must estimate the portion of waste requiring treatment which will go to the Swan Hills Centre, as opposed to the volume that will be handled by other means. There is even greater difficulty forecasting the volume of waste generated in past years which will eventually be treated at the Centre.

Notwithstanding the considerable uncertainty respecting the specific volume that would be available to the Centre, the Board is satisfied that there is a substantial volume that has been produced in the past that is stored at numerous locations throughout the province and which should be properly treated and disposed of. Additionally, large volumes of waste are being produced on an ongoing basis which, according to Chem-Security's unchallenged statement, cannot be handled at the existing Centre. (In this regard, the Board received letters from a number of industries in the province referring to the need for additional capacity to treat special waste).

The Board notes that SHERC, although recommending that the application not be approved until the volume available to the Centre is better defined, did not appear to oppose the position that some expansion was appropriate. In this respect, Mr. Staszenski stated that "I do accept the fact that there are volumes out there, the historic volumes that warrant further treatment and they are quite considerable. I guess my only concern is that we are picking the right size of expansion given what is out there...".

It is further noted that other interveners, including the Indian First Nations, opposed any expansion. They did not, however, present detailed information supporting the position that there was not sufficient waste in existence and being produced to justify an expansion. The thrust of the submission of the Indian First Nations was that the projections presented by Chem-

Security were not supported by sufficient backup material to allow proper assessment. As a result, no reliance should be placed on those projections in terms of supporting the need for an expansion.

The waste volumes projected by Chem-Security in its EIA were based on interviews with 94 major clients of a total 524 clients of the Centre. Those interviews led Chem-Security to estimate that some 25,000 tonnes per year of waste requiring treatment at the Centre is currently being produced. Dr. Zalinger, on behalf of the Indian First Nations, challenged the methodology that was used and indicated that insufficient information was available to place any reliance on the estimates. He did acknowledge however, that if the interviews with the 94 clients had been carried out in a consistent and effective manner, the resulting estimates could be relied upon with considerable certainty.

The Board was not provided with the detailed methodology employed in the interviews between Chem-Security and its clients, but considers that the approach of dealing directly with the waste generators is probably the best practical way to make a forecast. As Chem-Security is in the waste disposal business, the Board expects that Chem-Security's interviews with clients would have the advantage of being carried out by individuals knowledgeable with respect to waste. This, coupled with the knowledge that not all of the current clients were interviewed, and that the Bromley estimate of waste volumes currently available was some 47,000 tonnes per year, satisfies the Board that the Chem-Security estimate of 25,000 tonnes per year is likely a minimum volume of waste currently being generated which would be available to the Centre. A comparison to wastes being generated in other jurisdictions, and comments from Dr. Berkowitz regarding waste volume studies in the USA, also lend general support to such a conclusion.

There was some discussion at the hearing regarding the future regulation of hazardous waste, and at least one of the interveners suggested that since the expected regulations are now only in draft form, any predicted volume based on the regulations would be speculative. The Board recognizes that major changes are taking place with respect to the hazardous waste regulations. Further changes can be expected in future. The Board does not believe that these future changes will relax requirements regarding hazardous waste. In fact, the Board expects that the ongoing pressure will be towards tighter waste related regulations.

Chem-Security, apparently on the basis of the interviews with clients, suggested that the waste volume it forecast as currently available would grow at some five percent per year. SHERC and the Indian First Nations challenged this, suggesting there was no information put forward which could form the basis for such an assumption. The Bromley Report, although projecting a much higher volume as currently available, forecast a reduction in the ongoing volume of waste from the current level of some 47,000 tonnes per year to 37,000 tonnes per year over the next decade. The decline would be due, in part, to waste reduction efforts by generators of waste.

Although the Board recognizes that the 25,000 tonnes per year is likely a minimum volume of waste currently being generated and available to the Centre, it does not believe waste volumes should be projected to grow. In this respect, it agrees with Mr. Bromley's projection and the views of others that waste reduction efforts should reduce waste from most existing sources. Recognizing that Mr. Bromley's projection included substantial recognition of efforts to reduce the generation of waste at the source and a number of other conservative assumptions such as no industrial growth over the next decade, and that the Board is using what it believes to be a minimum estimate of the volume currently available, the Board believes that it is reasonable to assume no increase or decrease to that estimate of waste volume over the next 10 or so years. This means that for purposes of its assessment, the Board is accepting that on an ongoing basis, some 25,000 tonnes per year of waste would be generated and available to the Centre.

As indicated earlier, the Board believes there are also substantial volumes of waste that have been produced in the past, require treatment, and are stored throughout the province. Referring to this as the volume from inventory, the Board notes that Chem-Security's interviews with the 94 clients indicated that some 90,000 tonnes could be identified as being attainable from this source. Chem-Security used a conservative estimate of only 40,000 tonnes actually deliverable to the Treatment Centre. Mr. Bromley's work suggested that the inventory volume is much larger, and he estimated that deliveries from this source would range downward from 32,455 to 24,757 tonnes per year over the next decade.

The Board believes the Chem-Security estimate of waste from inventories is very conservative. Given the large volume of waste being generated on an ongoing basis, it is clear that a great deal has been generated in past years. Some of this is hazardous and requires special treatment. Given the relative absence of treatment facilities and a lower level of awareness regarding hazardous waste, the Board concludes that a considerable volume of such waste exists throughout the province. Some is known to exist and is properly stored. This volume may in fact have been the basis for the volume identified in the Chem-Security interviews. However, the interviews were with only 94 of Chem-Security's major clients, and today's major generators of waste and users of the Treatment Centre are not necessarily the major waste generators of past years. The remaining 430 clients of Chem-Security may have considerable inventories of waste, and there may be many non-clients of Chem-Security who have stored waste. Unfortunately, it is likely that there may be volumes of waste requiring treatment that no one has actually stored, but which have been improperly disposed of in the past. The Board believes these situations will increasingly come to light and that some of the waste will require treatment at the Swan Hills Centre.

The Board notes Mr. Bromley's estimate of almost 30,000 tonnes per year from this source, even though it assumes that only the past 10 years contributed to waste in inventory. The Board believes that such a volume may indeed be possible, particularly having in mind the likelihood that a significant volume of special waste has been improperly disposed of over the years and will require proper disposal in future. For purposes of its assessment, the Board is selecting a somewhat lesser level of 20,000 tonnes per year as an average volume that would be

available from inventories over at least the 10-year period following any expansion of the Treatment Centre.

The result is that the Board believes, on the basis of its review of the information submitted at the hearing, that a total of some 45,000 tonnes per year of waste will likely be available for treatment at the Centre. In reaching this conclusion, it is mindful of the comments of Mr. Howery on behalf of SHERC and Dr. Zalinger on behalf of the Indian First Nations. Both, but particularly Dr. Zalinger, questioned whether any reliance could be placed on the Chem-Security projections because sufficient supportive evidence was not provided. As indicated previously, the Board does not accept this position and believes that the submitted information does allow reasonable conclusions to be reached. With respect to the sparsity of detail regarding the interviews between Chem-Security and its clients, the Board understands the desirability for confidentiality on the part of waste generators. In this regard, it notes that Dr. Zalinger in describing certain approaches he believes acceptable to forecast waste volume, made reference to the need for confidentiality respecting certain data.

Although Mr. Howery questioned the reliability of the Chem-Security and Bromley estimates, the Board notes that he made a number of adjustments to the estimates and arrived at a range of estimated volumes of available waste as low as some 20,000 tonnes per year and as high as some 80,000 tonnes per year. Such a range may be possible, but the Board believes there is substantial probability that the waste volume will be in the central portion of the range. In this regard, it notes that its estimate of 45,000 tonnes per year is at about the mid-point of the range.

Having regard for its estimates and the knowledge that waste not properly treated and disposed of represents a potential hazard and financial liability to the public, the Board is satisfied that an expansion of the Treatment Centre is warranted. The more important question is whether or not the additional capacity of 40,000 tonnes per year as proposed by Chem-Security can be justified. Some of the interveners suggested that rather than expand incineration capacity, it might be better to wait until advances in technology lead to development of more effective treatment methods that would involve less risk to human health and the environment. Chem-Security suggested that leaving waste in place at contaminated sites or storing waste as it is generated, would give rise to greater risks in the long-term than would proper treatment by incineration. The Board agrees with Chem-Security and also notes that the emergence of more effective methods of waste treatment cannot be predicted with certainty.

Given the current capacity of the Centre, the projected availability for treatment of some 45,000 tonnes per year of waste would indicate that the expansion should either be by 40,000 tonnes per year as proposed, or perhaps some lesser amount, say about 30,000 tonnes per year. Recognizing the uncertainty in the estimates of waste available and the heating value of the waste, which impacts on the throughput capacity of the facility, there is probably not much to choose between the options, but each has advantages and disadvantages.

If the 30,000 tonne addition was selected there would be, in the Board's judgement, little likelihood the capacity would be more than required. There would be greater scope for using newer improved technology in future, but as indicated previously the Board does not see this as an overwhelming advantage. Assuming the 30,000 tonne expansion would be large enough, it would save at least $6 million in capital and operating costs of some $3 million per year, although the latter would be significantly dependent on throughput.

The major disadvantage of the 30,000 tonne expansion would result if it turned out not to be large enough. This could extend a situation where sufficient treatment capacity is not available, thus encouraging waste generators to not properly dispose of special waste. Also, and more importantly, if a further expansion was needed, there would be a substantial financial penalty. The Board estimates that the capital cost penalty of two expansions totalling 40,000 tonnes, as opposed to one, could be as much as $20 million. There would also be a substantial operating cost penalty, of up to $8 million per year. Combined, these financial effects would be considerably greater than the previously mentioned savings associated with a 30,000 tonne addition, if the 40,000 tonne addition turns out not to be fully needed.

An advantage of a 40,000 tonne expansion is that it is more certain to be large enough to handle future waste volumes, thus removing any incentive for waste generators to not properly dispose of special waste. Also, it would greatly reduce the chances of requiring a further financially inefficient expansion at a later date.

The major disadvantage of the 40,000 tonne expansion is the possible unnecessary use of financial resources for an expansion that might not be fully required. Several interveners raised the concern that excess treatment capacity could potentially create a disincentive to reduce waste production or an incentive to import waste. The Board does not believe that either of these should be significantly impacted by the size of the expansion. (These matters are discussed further in section 5.2.)

Having regard for the advantages and disadvantage of the two options, the Board believes it largely comes down to the following question:

> Do you proceed with an expansion that might be slightly over sized, recognizing the related unnecessary capital and operating expenditures if the full capacity is not needed, or, do you proceed with a smaller expansion, recognizing that if it is not of sufficient size it would require a further expansion with the related higher capital and operating expenditures?

The Board's economic analysis of the options suggests that the financial penalties of having to make a second future expansion are greater than those associated with an expansion larger than required at this time. Also, the Board believes the projection of waste volume on which it based its analysis, a total of some 45,000 tonnes per year, may well be conservative, at least for the period when waste stored throughout the province is being recovered and properly treated. For this reason, the Board believes there is adequate justification for the

addition of a 40,000 tonne per year incinerator as requested by Chem-Security. Therefore, it would be prepared to approve the proposed expansion if judged to be in the public interest having regard for the related social, economic and environmental effects.

In arriving at this conclusion, the Board acknowledges that there is not an overwhelming case to support the particular capacity expansion. It gave considerable thought to the suggestion by SHERC and others that no expansion be approved until the available waste volume is better defined. Recognizing the numerous generators of waste throughout the province, the large volume already in existence at many locations, some of them unknown, and the relationship between the type of waste, its heating value and the incinerator capacity, the Board questions whether additional studies would add much certainty to the estimates, unless they were massive and extremely detailed. This conclusion is supported by evidence provided at the hearing about the costs and time delays that have been encountered in carrying out detailed waste studies in other jurisdictions. As a result, the Board does not believe that such further studies would be justified.

5.2 Other Related Matters

There were a number of matters raised at the hearing that relate to the volume of waste which might be available in future to the Treatment Centre and the sizing of the proposed expansion. The most important were the possible impacts of the proposed expansion on efforts to reduce the amount of waste requiring treatment in the province, or waste minimization, and the issue of whether or not waste should be brought into Alberta from out of province for treatment and disposal.

5.2.1 Waste Minimization

Several of the interveners, most notably SHERC and the Indian First Nations, raised concerns that the proposed expansion might result in the availability of excess capacity, which in turn, might serve as a disincentive to pursuing waste minimization. SHERC defined waste minimization as the reduction or elimination of the generation of special waste at the point of production.

SHERC stated that the most desirable method for managing special waste was to provide incentives and promote efforts to reduce the production of waste at the source. It also pointed to recycling or reuse of special waste and the recovery of useful material or energy from such waste, as waste management options which were more desirable than the treatment and disposal method provided at the Treatment Centre. It suggested that treatment and disposal should be a "last resort", but acknowledged that such processes were needed.

Mr. Howery, on behalf of SHERC, suggested that the various options which will minimize the volumes of waste requiring treatment can best be left to industry if there are sufficient incentives. He pointed to a number of barriers which stand in the way of industry minimizing waste volume, the most significant of which are economic or financial in nature.

These result because treatment is often seen as being cheaper than the more desirable options, particularly because many of the costs to society of producing the waste, then treating and disposing of it, are not internalized to the organization which produces the waste.

It was acknowledged that the Government of Alberta has policies and regulations which reduce the production of waste and that changes are being made which will further assist the realization of this goal, but Mr. Howery raised the question as to whether these would be sufficient. He pointed to a wide variety of programs elsewhere in North America in this regard.

SHERC suggested a number of ways in which policies could result in greater incentives to reduce the amount of waste requiring treatment. For example, it raised the possibility that new waste being produced from ongoing operations might pay a much higher treatment fee than stored or inventory waste which was produced in the past and now requires treatment.

SHERC and the Indian First Nations took the position that the proposed expansion should not be approved until an adequate Demand Side Management Plan was in place. Demand side management was defined as an approach to control and influence the magnitude and timing of demand for a product or service. SHERC stated that incorporation of an appropriate Demand Side Management Plan into the operating practices of the applicant would have the benefit of creating a more socially optimum approach to special waste management.

SHERC also addressed the question of whether Chem-Security or others involved in the ownership and operation of the Centre, should have an expanded role to play regarding the minimization of special waste. It stated that Chem-Security was currently the entity which had the greatest knowledge of the different wastes being produced and how they should be handled. At the same time, it expressed concern that Chem-Security doesn't appear to recognize the minimization of waste as the most important part of its mandate. SHERC suggested that the Crown Corporation, ASWMC, might have a greater role to play in that respect.

Regarding the position that a proposed expansion would result in the availability of excess capacity, Chem-Security contended that the expansion was appropriately sized having regard for the waste volume studies carried out on its behalf. It disagreed with the suggestion that it had financial incentives to process as much waste as possible, and that the availability of excess capacity would result in a reduced emphasis on waste reduction.

Chem-Security did not disagree with the position of several interveners that reducing the volume of waste was a more desirable option than treatment and disposal. It indicated that it encourages waste minimization and that its sales staff routinely make suggestions to generators regarding available waste management options. Chem-Security stated, however, that there are thousands of waste streams and it is not expert in all areas. Additionally, Chem-Security stated that its primary job is operating the Waste Management System and the Treatment Centre, and that although it could assist with waste reduction programs, others including waste generators appear to be doing an adequate job.

Chem-Security agreed that there should be a highly successful waste minimization program put in place, and stated that such was a basic assumption in its waste volume projections. However, it argued that a program such as a Demand Side Management Plan could not be a substitute for the needed expansion of the Centre. It pointed out that in Alberta certain waste that exists in substantial volumes, such as volatile organic compounds from the petroleum industry, are part of the raw material being produced. As a result, source reduction would be extremely difficult. It was also indicated that a Demand Side Management Plan is premature for new industries and more appropriate for utilities.

The Board agrees with all of the participants in the hearing that reducing the volume of waste requiring treatment is a superior method to treatment and disposal. However, as pointed out in section 5.1, even with an effective reduction program, and having regard for the substantial volume of waste now stored throughout the province, it believes a substantial volume of special waste will continue to require treatment for many years into the future. As a result, it does not agree with the recommendation from SHERC that expansion of the facility should be deferred until a Demand Side Management Plan is in place. There will likely be times when the proposed expanded Treatment Centre would not be fully utilized, but this need not stand in the way of efforts to reduce waste at the source.

The generators of waste and Chem-Security as operator of the Waste Treatment System can play a role in waste minimization. However, the Government of Alberta through appropriate policies and regulation, must take a lead role. Many examples of how this is now being done were put forward at the hearing. The Board finds this commendable and urges the Government of Alberta to continue to pursue the objective of reducing the volume of waste requiring special treatment.

Although the Board believes Chem-Security will continue to play a role in waste minimization, as it has in the past, it questions whether Chem-Security should appropriately carry the lead role. It may be that the Crown Corporation, ASWMC, should play the active direct role, leaving Chem-Security with the principal task of operating the Waste Management System and Treatment Centre in an effective and safe manner.

In order to ensure that waste minimization continues to attract the required emphasis, the Board recommends that the Government of Alberta document to a greater extent, and communicate more extensively to the public, its ongoing plans in this regard.

5.2.2 Waste from Out of Province

SHERC, the Indian First Nations and a number of other interveners expressed concern that if excess capacity exists in future at the expanded Centre, this could result in an incentive to import special waste from outside the province for treatment. SHERC stated that it opposes moving special waste into Alberta from elsewhere because the public would face the environmental and social risks of moving this waste over great distances for processing at the

Swan Hills Treatment Centre. It said that, although waste minimization should be the first priority, it agrees with the concept of treating Alberta waste at a single location in the province. It also stated that other provinces should follow the lead of Alberta in terms of being responsible regarding waste and "act accordingly as well".

Mr. Wilde said that it had not been demonstrated at the hearing that waste from out of province would or would not be brought to Swan Hills for treatment, and the environmental reasons for making the choice had not been dealt with. Mr. Howery suggested that the issue of importing waste should be dealt with separately and the availability of excess capacity at the Centre should not be allowed to cause the movement of waste into Alberta without specifically dealing with the matter. Chief Badger said "I do not want to see Alberta become a hazardous waste point in North America".

Mayor Peters stated that the importation of special waste was not a policy of the Government of Alberta so the question had not been dealt with by the Town of Swan Hills. He inferred that a plebiscite would be the appropriate way to gauge the views of the citizens of Swan Hills if a change to the policy was to be considered.

Chem-Security took the position that the question of bringing in waste from other provinces was a Government policy decision and not a matter for Chem-Security to decide.

The Board notes the reference at the hearing to the statement by the Alberta Minister of the Environment that the Government's policy does not allow for the importation of special waste. It also notes that the statement says there will be no change to the policy without formal consultation with Albertans.

The Board agrees with several of the participants that the importation of waste is a Government policy issue and that the hearing was not for the purpose of reviewing that policy. The Board's assessment of the application is on the basis that the existing policy will remain in place. It assumes that any change to the policy would occur only after consultation and an assessment of the advantages and disadvantages to Albertans. It recommends that any such assessment include consideration of the issues dealt with in this report and the impacts on those issues that would result from a change of policy.

PCBs, for example, represent one issue which could possibly be affected by a change to the current policy. As indicated in the analysis of the PCB issue in section 7.5.3, changing the existing Government policy to allow for the importation of waste from out of the province could specifically affect those estimates of concentrations of contaminants in the environment that were used by the Board in assessing the application. If the importation of PCB contaminated waste was allowed and the throughput of PCBs at the Centre increased rather than declined as Chem-Security expects, concentrations of PCBs in the environment could increase. A reassessment of risk to human health and the environment would be required prior to any change in policy allowing for greater than projected quantities of PCBs or other special materials to be processed at the Centre.

6. SELECTION OF TECHNOLOGY AND VIABILITY OF THE PROPOSED EXPANSION

6.1 Selection of Waste Treatment Technology

Section 5.1 of this report dealt with whether the Swan Hills Special Waste Treatment Centre should be expanded, and if so, the appropriate capacity of the expansion. It assessed various broad alternatives to the Chem-Security proposal, including matters such as the reduction of the rate of waste generation and the consequences of not expanding the Centre. This section deals with the selection of the technology that should be utilized should an expansion be justified. It will deal only with the broad issue of the type of technology that should be utilized, such as the choice between thermal or biological treatment. Subsequent sections will, as appropriate, deal with technological details, including the appropriate technology to minimize emissions which is discussed in section 7.

Chem-Security indicated that it had evaluated a number of alternative waste treatment technologies including thermal treatment, waste storage, waste export, solidification, fuels blending, biological treatment and landfill. The main criteria considered in the assessment included:

- a commercially proven record;
- the capability to treat the specific waste generated in Alberta and the flexibility to handle different waste forms;
- the proven capability to meet stringent environmental standards;
- the treatment costs; and
- the efficient use of resources.

Chem-Security concluded that thermal treatment is the preferred alternative because it is well suited to the type and volume of waste to be handled, it has a proven record of reliability, and the existing Treatment Centre which is being expanded currently utilizes thermal treatment technology.

A number of thermal treatment technologies were evaluated including rotary kiln incineration, plasma arc incineration, infrared incineration and fluidized bed incineration. Rotary kiln technology was selected because it is the most flexible in terms of the type and volume of waste it can handle, and has a proven record of reliability. The applicant also pointed out that the United States Environmental Protection Agency (US EPA) deems such an approach the best available technology to deal with organic waste. The applicant said that it monitors research into new technologies but that considerable time, work and expense is required before the few successful research technologies can be integrated or utilized in a viable commercial treatment plant. At this time, none of the more recent technologies are commercially proven.

Although several of the interveners questioned the need for and size of the proposed expansion, emphasizing waste minimization as superior to any method of treatment or disposal, none appeared to challenge the use of rotary kiln incineration technology if the Treatment Centre is to be expanded at this time. Several suggested that any expansion should be delayed until better technology is available. EFONES specifically drew the Board's attention to a number of alternative technologies being used at various locations throughout the world, but did not specifically recommend that some other technology be used.

The Board has reviewed the reasons put forward by the applicant for its choice of rotary kiln incineration technology. On the basis of that review and recognizing that the existing Treatment Centre utilizes a similar technology, the Board concludes that the technology chosen by the applicant is well suited to handle the specific waste generated in Alberta and is capable of successfully doing so, provided the expanded Centre is designed and operated in accordance with stringent environmental standards. The Board agrees with Chem-Security's plans to use the proposed expansion, as opposed to the existing facilities, whenever it is in a period of excess capacity. This will make for better overall performance, and the capability to do so is supported by the particular choice of technology.

6.2 Technical Ability of the Applicant to Construct and Operate the Facilities

Chem-Security stated that it is well equipped to design and operate the proposed expansion because it designed and constructed the existing facility and has been responsible for its operation since 1987. The existing operating protocols would be upgraded and improved so that when applied to the new and better equipment and operating controls to be installed, the expected operation of the proposed expansion would be superior to the existing operation. Chem-Security emphasized steps would be implemented to accurately sample and analyze delivered waste and to ensure that detailed feed rate and operating parameters are established. It confirmed that the operation of the Centre would be in accordance with all legislation, regulations and standards.

The applicant indicated that experienced staff from the existing operation and additional staff recruited would receive hands-on training to ensure that they are capable of efficiently operating the proposed expanded Centre. The number of operating personnel available would increase from three to five for each shift, and individuals would be required to have several years of experience before they would be responsible for operating the facility.

Chem-Security also pointed out that it had worked closely with Alberta Occupational Health and Safety to ensure the design and operation of the existing Treatment Centre minimized workers' exposure to possible harmful substances. It stated that it would do likewise for the proposed expansion. (The matter of worker safety is dealt with further in section 7.6.)

Several of the interveners raised concerns that operating standards should not be compromised in order to reduce costs or for any other reason. A technical consultant's report filed by SHERC indicated that the incinerator could likely meet the proposed standards if the

operating conditions were met on a continuous basis. SHERC pointed to the need to always maintain optimum operating conditions, particularly for the incinerator, if global warming increases the average ambient temperature by a few degrees.

With respect to the possibility of compromising operating standards, Chem-Security stated that one reason for the detailed agreement with the Crown Corporation for the ownership and operation of the facility was to eliminate any incentive to compromise operations. Regarding global warming, the applicant stated that the incinerator was designed to operate efficiently in temperatures from -40°C to +30°C so that a minor warming in the average ambient air temperature, if it did occur, would not have a significant impact on operations. The only possible change would be a slight derating in the throughput capacity in the planned heat-exchange system.

The Board is satisfied that Chem-Security is fully capable of designing, constructing and operating the proposed expansion to the Swan Hills Special Waste Treatment Centre, but agrees with several of the interveners that diligence and care will be required at all times to ensure successful operation.

6.3 Economic Viability and Ability of the Applicant to Finance

Chem-Security estimated that the capital cost of the proposed expansion would be approximately $60 million and that it would have a useful economic operating life of 20 years. The capital would be provided 60 percent from Bovar utilizing an appropriate debt:equity ratio, and 40 percent by ASWMC using grants and loans from the Government of Alberta.

The treatment prices to be charged at the facility will be set by the owners, Bovar and ASWMC, and will be intended to reflect the cost of other waste treatment options available in North America. Chem-Security continually monitors what is taking place with respect to waste, reviews its own charges, and makes recommendations to the owners on an on-going basis. It pointed out that ASWMC, in determining whether it accepts the Chem-Security recommended prices, follows a philosophy that it wishes to have prices high enough to reflect the concept of user pays, but not so high that waste generators will avoid sending waste to the Centre and use less attractive methods of disposal.

Chem-Security provided estimated waste treatment charges for the first year of operation at the Centre that range from as low as $400 per tonne for liquids to as high as $3,000 per tonne for small quantities of mixed waste. It estimated that prices would likely escalate at about 7 percent per year. Using the projected prices for treatment, the $60 million capital cost, estimated operating and maintenance costs, and the forecast of the volume of waste available to the Centre, Chem-Security estimated that revenue during the initial 10-year operating period would meet all operating and other expenses, service the debt, and recover the invested capital.

A number of the interveners raised questions with respect to the financing of the proposed expansion and its economic viability. They pointed to the Joint Venture Agreement between Chem-Security, Bovar and the Crown corporation, ASWMC, and suggested that the general public were at financial risk if the expansion resulted in excess capacity. It was suggested this would result because the agreement includes a guaranteed rate of return on investment to Bovar, a subsidy where waste generators were charged less than market rates, and a subsidy if market rates were not enough to allow the operation to break even. This group of interveners generally took the position that the more money Chem-Security spent, the greater would be the return to its parent company, Bovar. They suggested that this not only put the Alberta public at financial risk, but provided incentives for Chem-Security to build a larger than needed treatment facility, to downplay the concept of source reduction of waste rather than treatment and disposal, and to import waste from out of the province.

The Board, in section 5 of this report, expresses its views regarding the size of the proposed expansion, minimization of waste, and the possibility of importing waste. In terms of the economic viability of the proposed expansion, the Board recognizes the uncertainties regarding the volumes of waste that will be available to the Treatment Centre over the next 20 years. Notwithstanding the uncertainties, the Board carried out an economic analysis using data provided in the application and at the hearing. The results suggest that over the range of waste volumes the Board expects might be delivered to the Centre, and most of the possible range for treatment prices given by Chem-Security, the project would be economically viable. Indeed, the economic calculations made by the Board cause it to agree with the suggestion of Chem-Security that expanding the Centre to treat all available volumes of waste would go a long way to ensuring that it does not need financial support from the public.

The Board recognizes that the uncertainties associated with the future volumes of waste delivered to the Centre are such that in certain possible circumstances, the proposed expansion would not generate sufficient revenue to pay for itself. In these circumstances, and in accordance with the policy of the Government, the resulting costs would be borne by the Alberta public. That risk is, in effect, the cost to the public of ensuring the availability of safe and effective treatment facilities.

It is the Board's view that the previously described government policy pre-supposes that a facility like the Swan Hills Special Waste Treatment Centre would not be expanded to a capacity which could not be justified having regard for the expected waste volume, nor operated in a manner which was not business-like and designed to safely and efficiently treat and dispose of the waste. The terms of the Joint Venture Agreement are such that the Crown Corporation, ASWMC, which in effect represents Albertans, would not be expected to allow an unwarranted expansion nor inefficient operations to take place. In this particular instance, the jurisdiction of the NRCB and the assessment it has made in section 5 on the justification for the proposed expansion, is a further safe-guard against such occurrences.

On the basis of the Board's assessment contained in section 5 of the waste potentially available to the Centre, and its economic analysis, the Board concludes that there is considerable likelihood that the proposed expansion will prove to be economically viable on a stand-alone basis. This, coupled with the terms of the Joint Venture Agreement between Chem-Security, Bovar and ASWMC, causes the Board to conclude that the proposed expansion can be financed in the manner described by the applicant.

7. EMISSIONS FROM THE CENTRE TO THE ATMOSPHERE

Emissions from the Centre to the atmosphere are of interest to the Board because they may contain substances hazardous to human health or to components of the environment.

People and animals inhale air which may include toxic gases or suspended particles consisting of, or contaminated by, hazardous substances. The same substances may precipitate from the atmosphere onto plants and soil or into water (dry deposition), or be washed from the atmosphere onto the same receptors by rain or through condensation in fog (wet deposition). Groundwater may be contaminated as it is recharged from surface water. Plants may take up deposited hazardous substances from the soil or from surface water. Animals and humans may take up deposited hazardous materials by inhaling resuspended dust, licking contaminated surfaces, or eating contaminated material including soil, plants and other animals. Passage of contaminants through such a food chain may lead to bioaccumulation, i.e., the retention of contaminants in an organism so that their internal concentration increases to exceed that in the food, and biomagnification, as the concentration of contaminants increases with each step of the food chain, i.e., from plants to herbivores to one or more levels of carnivore.

All of these pathways lead to the exposure of humans and other environmental components to increased doses of contaminants which, in turn, give rise to risks to health or environmental quality. Doses are "increased" in most cases because there is already a background level of exposure to most contaminants, arising from natural sources or from existing industrial activity. The Board believes it must determine whether the risks to health and environmental quality that are expected to arise from operation of the proposed expanded Treatment Centre are acceptable.

In order to make this determination the Board has considered the extensive body of evidence presented by the applicant and interveners about the expected composition and quantity of emissions from the proposed expanded facility and the movement of contaminants through each step in the pathways to exposure that are briefly set out above. This report deals with them in sequence from the point of emission to the assessment of the health risks occasioned by the predicted exposures. The Board notes that the evidence provided by Chem-Security about the operation of the existing Treatment Centre, including the results of monitoring its effects, has made possible a more detailed review than would have been the case for an entirely new facility.

7.1 Emissions

7.1.1 Composition and Quantity of Emissions

Atmospheric pollution from the handling and combustion of waste materials poses the greatest potential for impacts on the environment and human health arising from the operations of the Treatment Centre. Much of the assessment therefore rests on the completeness and plausibility of estimates of pollutant emission rates. The applicant obtained emission rates of

pollutants released by the existing incinerators directly from measurements of effluent concentrations and flue gas flow rates. Concentrations of the common combustion products, temperature and flue gas flow rates were measured with a continuous stack emission monitor (CSEM). Other parameters were measured quarterly in manual stack surveys undertaken to ensure compliance with licence limits. Emissions of dioxins and furans from the rotary kiln were found to exceed licence limits during certain operating conditions, but have subsequently been reduced below compliance levels by changing operating conditions. Emission data were also obtained for a broader range of chemicals during trial burns on a mobile incinerator that was temporarily situated at the Treatment Centre in 1989 and 1990. Altogether, data were available on 139 contaminants likely to be emitted by the incinerators.

The applicant obtained estimated emission rates for the proposed new incinerator by multiplying emission concentration statistics for the existing incinerators by the design stack flow rate for the proposed incinerator. The "extreme emission rates" employed in the plume dispersion modelling were the greater of the expected means plus three standard deviations and the expected maxima for all non-regulated contaminants, except metals and oxides of nitrogen (NO_x). Currently, no specific regulations govern the emission of metals and most organic contaminants. Extreme rates for metals were multiplied by the ratio of the licensed rate to the expected extreme rate for total suspended particulates (TSPs), on the assumption that the new incinerator will comply with the TSP limit. Accordingly, the estimated extreme emission rates for metals in the proposed incinerator were reduced by a third. The extreme NO_x value was estimated based on the 99th percentile of the emission concentrations observed in CSEM monitoring.

The small set of contaminants for which Alberta Environment specifies compliance limits were treated slightly differently. For regulated inorganic constituents, the applicant assumed that maximum emission rates were those obtained by multiplying the licensed limit concentrations by the design stack flow rate. In the case of 2, 3, 7, 8 tetrachlorodibenzo-p-dioxin (2, 3, 7, 8 TCDD) equivalents, a more conservative approach was taken, in that the licensed limit is 0.5 nanograms per cubic metre (ng/m^3) whereas the maximum contaminant emission rate for the proposed incinerator that was assumed for the purposes of the health risk assessment is 66 ng/m^3. Estimates of polychlorinated biphenyl (PCB) emissions were obtained by assuming a maximum PCB feedrate and a destruction and removal efficiency (DRE) of 99.9999 percent as required in the licence.

Chem-Security selected sixty-seven priority contaminants from the larger set as having the greatest potential to affect human health. The health risk assessment in the EIA was based on the emission estimates for these priority contaminants. Chem-Security also provided information about emissions of some of these contaminants during emergency venting, and as fugitive emissions from the decant building, heated storage building and tank farm during normal operation. Estimates of emission rates from all sources were incorporated into the dispersion modelling.

SHERC identified 13 substances among those emitted by the Centre that belong to the "level of concern 1" category of the priority list of atmospheric pollutants prepared by the Province of Ontario Clean Air Program. Level of concern 1 pollutants are deemed to present a high hazard to the environment because they are known or suspected carcinogens or because they accumulate or bioaccumulate in the environment. SHERC suggested that greater attention should have been paid to quantifying emissions of level of concern 1 pollutants, and to the organic constituents in particular, rather than concentrating on the common gaseous products of combustion. The applicant noted that all 13 of the level of concern 1 pollutants that are on SHERC's list were included among the 67 priority contaminants reviewed in the EIA. The applicant also stated that the Ontario list of priority pollutants was intended for use with general industrial sources rather than hazardous waste incinerators and that some pollutants emitted from other sources would not be expected to be emitted from the Treatment Centre. In addition, emission standards for incinerators designed to destroy special wastes may not be identical with those intended to be of general application. The applicant observed that the estimation of the quantities of toxic organic substances that might be present in smaller amounts in the flue gases is difficult because many are present at concentrations below detection limits. Monitoring methods using natural receptors or equipment that gathers and accumulates the emitted substances offer the only practical means of estimating the quantities of such emissions. This constraint did not allow the same level of detailed analysis of low concentration contaminants as could be applied to the more abundant combustion gases.

SHERC noted that extrapolating the maximum rates of emission of some pollutants, such as lead and arsenic, to annual volumes generates much higher quantities of such pollutants than are accounted for in the predicted ground-level concentrations and annual deposition rates presented in the EIA. Dr. Hrudey, on behalf of the Town of Swan Hills pointed out that annual emissions would be much smaller than the quantities obtained by assuming that maximum emission rates continued throughout the year. In addition, the average emission rates would be much smaller than the maximum rates and the actual period of operation would be much less than the entire year if past performance of the smaller kilns at the Centre could be taken as a guide.

The Board is satisfied that the applicant has instituted appropriate measures to detect and determine quantities, where significant, of flue gas emissions from the existing Centre and that it would do so for the proposed expanded Centre. However, the Board recognizes that as time passes and the Centre continues to operate, more attention may need to be paid to substances that are emitted in quantities below detection limits but which accumulate in the environment. The Board recommends that Alberta Environment and the applicant take this into account when modifying the design of monitoring programs in the future.

The Board is satisfied that Chem-Security's estimates of emission rates for normal operations were appropriately conservative, that is, they probably overestimate actual stack emissions. Emission estimates in the special case of regulated inorganic pollutants were scaled down by Chem-Security to reflect the anticipated superior performance of the proposed incinerator. These values represent compliance limits for Chem-Security's licence under the

Clean Air Act and are monitored by Alberta Environment. Emission estimates for metals were also scaled down because the applicant expects that the emission concentration of TSP's will be lower in the proposed incinerator than was the case for the existing incinerators. The Board believes that these estimated emission rates provide a conservative and therefore reasonable basis for the assessment of environmental and health risk impacts. The Board is confident that any discrepancies between the expected performance of the proposed incinerator and the actual performance would be detected by the applicant's monitoring program and reviewed by Alberta Environment.

Difficulties with the treatment of emergency venting emissions and fugitive emissions are dealt with in sections 7.1.6 and 7.1.7 respectively.

7.1.2 Method of Setting Stack Emission Limits

The applicant indicated that the proposed expanded Centre is designed to meet stack emission limits required through the licensing process of Alberta Environment. Limits for regulated inorganic parameters for the existing and proposed Centre are presented in Table 3-8 of the EIA. Limits for dioxins and furans are presented in Table 3-8R of the Supplementary Information.

At the hearing, there was particular interest in how emission limits are defined for pollutants on the list of level of concern 1 priority pollutants identified by the Province of Ontario and referred to in section 7.1.1. The applicant observed that setting emission limits is very difficult in the case of pollutants that are present in very low concentrations. In general, the applicant accepts the US EPA "six nines" or 99.9999 percent removal target, but it acknowledged that verifying compliance with that target is impossible when pollutants are present at concentrations below detection limits. This difficulty will apply to many of the list of priority pollutants referred to above. In practice, decisions about the acceptability of emissions of these pollutants can only be based on results of monitoring their accumulation in the environment in the vicinity of the source.

Chem-Security also indicated that it and Alberta Environment will continue to review:

- reports of the design and operating performance of other similar facilities in other countries;
- changes in regulatory standards and requirements in other jurisdictions; and
- the performance of the proposed expanded Centre at Swan Hills, including the results of the monitoring of emissions from the expanded Centre and the accumulation of emitted substances in the environment nearby.

Using this information Chem-Security and Alberta Environment will continue to review licence conditions including stack emission limits on at least an annual basis and Alberta Environment will make changes to the conditions as appropriate.

The Board accepts that the approach to defining stack emission limits as described by the applicant, and as practiced by Alberta Environment with the assistance of the applicant, is reasonable. The Board recommends that Alberta Environment continue to review annually the requirements of the clean air licence issued to the applicant, taking into account the three kinds of information listed above.

7.1.3 Selection of Pollution Control Equipment

Exhaust gases leaving the kiln will enter a "pollution control train": that is a series of pieces of equipment designed to cool the gases and reduce emissions of undesirable substances to the atmosphere.

The first unit of the pollution control train is the afterburner or secondary combustion chamber. Its objective is to take to complete combustion any remaining uncombusted or partially combusted materials leaving the kiln, by providing a sufficiently high temperature, an adequate residence time (based on volume, flow rate and flow pattern), enough excess oxygen (to allow complete oxidation) and the necessary degree of mixing. The final combustion products of hydrocarbons are carbon dioxide and water. Chlorine present is converted to hydrogen chloride (HCl) and sulphur to sulphur dioxide (SO_2).

The afterburner is followed by the spray dryer which converts liquid wastes to solids, eliminating the need to use deep well injection for liquid wastes arising from the new rotary kiln. It achieves this by evaporating the liquid leaving the wet scrubbing system. The spray dryer also results in the cooling of the flue gases.

The next unit is the electrostatic precipitator (ESP). This device permits the removal of particulates via the application of an electrical field. Wastes collected from this unit are solids which are committed to the secure landfill cells. At this point, the exhaust gases enter the wet scrubbing system, the effluent from which goes to the spray dryer.

The multi-stage scrubber removes HCl, SO_2, particulates (of those remaining after the ESP) and aerosols. It consists of four stages. The first is a quenching stage which cools the flue gas and drops its temperature to below the saturation point so that vapour can be condensed to liquid form. This is followed by the second stage which removes HCl, the third which removes SO_2 and the fourth, high pressure-drop venturi scrubbers, which remove particulates and aerosols. Parameters such as molecular oxygen (indicates afterburner status) and SO_2 (indicates the performance of the wet scrubbing system) are continuously monitored and the output is hooked into an interlock safety control which will shut down the waste feed system if irregularities are detected.

SHERC and the Alberta Trappers Association questioned the use of an electrostatic precipitator rather than a baghouse in the pollution control train that will be mounted downstream of the proposed incinerator. SHERC stated that emissions from an electrostatic precipitator are a constant proportion of inlet concentration whereas emissions from a baghouse increase only marginally with load except during short periods before the cloth has acquired a thin layer of filter cake. It argued that a baghouse would be more effective than an electrostatic precipitator in particulate removal under most operating conditions.

Chem-Security's response to this issue was twofold. First, differences in performance between baghouses and electrostatic precipitators depend on operating conditions. For example: fabric filters are typically bypassed during start-up, shutdowns and "process excursions". This means that there would be more direct venting of emissions from the incinerator to the atmosphere if a baghouse were used. Secondly, the applicant emphasized that the performance of the entire pollution control train is the significant issue, rather than the performance of individual components in isolation. Chem-Security's position is that the operation of the pollution control train as designed, with fine tuning of operating conditions based on test-burn experience, will accomplish the objective of ensuring that emissions meet licence target concentrations.

SHERC and Alberta Environment both appeared to question the applicant's design objective of meeting licence requirements for emissions. The alternative objective that might be considered is aiming for the maximum possible reduction in emissions of potentially harmful substances. Chem-Security's position is that reliance on technology that has proved capable of achieving the target level of performance elsewhere is safer than attempting to achieve superior performance by what would have to be experimental methods.

SHERC and Alberta Environment also raised the question of whether observations of performance of the pollution control train at other plants are applicable to the proposed incinerator at Swan Hills. Information about the composition of the feedstock at the other plants is lacking. Composition of the feedstock influences the composition of emissions; if the feedstock at the Centre differs significantly from that at the other plants, observations made at them would not be applicable to the Centre. In particular, concern was expressed about feedstock with high chlorine content and the emission of dioxins and furans that are formed in the pollution control train under certain conditions of operation when chlorine is present in the feedstock.

Chem-Security, SHERC and Alberta Environment agreed that dioxin and furan emissions can be reduced by lowering the temperature of flue gases at the beginning of the pollution control train and operating the remainder of the train at relatively low temperatures. The applicant expressed the intention of fine tuning the operating conditions in the pollution control train to produce the lowest emission concentrations of dioxins and furans that can be achieved without increasing concentrations of other pollutants to unacceptable levels. Operating conditions would be varied for different feedstocks. The process of fine tuning may be difficult because of theoretical and practical limits to the detectability of pollutants in flue gases at very

low concentrations. As a result of this exchange of views, the Board concluded that the steps proposed by the applicant are the only practical alternative available to an operating facility, but that there is some doubt whether the new, more stringent target for dioxin and furan emissions could be met under all circumstances.

The Board accepts Chem-Security's argument that the performance of the entire pollution control train and the concentrations and amounts of pollutants emitted to the atmosphere should be the focus of attention. The Board believes that the applicant is acting responsibly and in the interest of Albertans in making its first priority meeting the licensed limits for pollutant concentrations established by Alberta Environment. In the Board's opinion, the alternative of adopting an experimental approach to achieving a higher level of performance, and accepting the greater risk of failure that such an approach brings, is less desirable.

The Board accepts that the applicant will take all reasonable steps to fine tune the operating conditions of the pollution control equipment in order to optimize emissions when each of the various types of feedstock are incinerated. Optimize as used here means maximum destruction and minimum emission of toxic substances. The Board is satisfied that Alberta Environment will review and approve the results of such fine tuning as part of its annual licence review. Possible difficulties in meeting the new targets for dioxins and furans are further reviewed in section 7.1.5.3.

7.1.4 Recovery of Waste Heat from the Incinerator

SHERC asked about the possibility of recovering waste heat from the incineration process as is practiced elsewhere, including at the Hessische Industriemull Gmbh. (HIM) facility at Beibesheim in Germany. Chem-Security stated that it had been and was still considering the addition of a heat exchanger to recover heat for use in a greenhouse. The greenhouse would be used to raise tree seedlings. Unfortunately, the incorporation of a heat exchanger may affect the efficiency of the pollution control train in removing pollutants; for that reason, the applicant had not yet made the decision to recover waste heat.

The Board agrees with the reasoning of the applicant and requires that a heat recovery system not be installed unless Alberta Environment is satisfied that operation of the Centre including the heat recovery system will continue to meet licensed emission limits.

7.1.5 Routine Performance of the Kiln and Pollution Control Train

7.1.5.1 Sampling and Preparation of Feedstock

When waste arrives at the Swan Hills Centre for treatment, the applicant must either test its composition or depend on information supplied by the waste generator. Chem-Security stated that it has a set of protocols that are followed to determine the composition of waste and how it will be treated. These include core sampling of waste loads, chemical analysis of core samples and routing to different treatments based on the analytical results. The existing

protocols have been developed for, and proved adequate to deal with, existing waste streams processed at the Centre and the intention is to use them at the proposed expanded Centre. Objectives of the protocols are to identify material not suitable for incineration, to avoid the presence of strongly reacting mixtures in the incinerator and to maintain the heat value of the feedstock within the desired range. Materials rich in metals would be sent for solidification and put in landfill cells rather than incinerated. Although no concentration threshold for this choice was provided, the applicant stated that no wastes had been processed in which concentrations of metals were too high to allow incineration.

Alberta Environment identified the potential problems raised by a frozen or solid waste load that is chemically heterogeneous, pointing out that use of a single core sample could give unrepresentative results and lead to inappropriate treatment. The applicant agreed that this could present a problem and stated that it has been relying on information from the waste generators to assure itself of the homogeneity of loads of solid waste and of the contents of drums of solid waste or sludge.

While the Board accepts that the applicant's procedures are adequate for dealing with waste streams currently arriving at the Centre, it requires that, in the event that waste loads are received at the plant with compositions significantly outside the range so far experienced, the applicant review its protocols for sampling and treatment of such material with Alberta Environment. In particular, the Board is concerned about the potential risks of incinerating wastes containing heavy metals and recommends that the applicant and Alberta Environment develop a protocol limit or series of limits to be applied to the concentrations of heavy metals in material to be incinerated.

The Board accepts that reliance on single core samples and information from waste generators would normally be adequate to determine the composition of incoming waste loads, but it recommends that if waste loads arrive at the Centre that are sufficiently heterogeneous that single core samples are inadequate to characterize them, are frozen or are otherwise difficult to sample, Chem-Security should develop, and Alberta Environment review, a protocol for sampling them before treatment begins.

7.1.5.2 Composition of Feedstock and Test Burns

Having determined the composition of incoming waste, and that it is suitable for incineration, it remains for the applicant to determine whether it can be incinerated without exceeding any of the emission limits required through licences issued by Alberta Environment. Chem-Security does this by trial burns of wastes during which operating conditions are varied until optimum results are obtained. Optimum results means maximum destruction and minimum emission of toxic substances. It is also important to ensure that sample wastes used in test-burns are representative of expected future waste streams. Chem-Security selects test burn materials with two objectives in mind:

- to cover the types of waste expected to be incoming; and
- to test destruction and emissions of specific substances.

In the latter case, waste samples are often "spiked" with particularly refractory substances such as PCBs, other chlorine containing compounds, or sulphur containing substances. PCBs are now in short supply in Alberta and may have to be replaced as test materials by carbon tetrachloride, sulphur hexafluoride or tetrachlorobenzene.

Test materials or surrogates are necessary to establish and maintain an ongoing check on the effectiveness of the incineration system in destroying 99.9999 percent of the compounds of concern. In the opinion of the Board, it is important that the relationship between the behaviour of the surrogate and that of the compound of concern has been quantitatively determined by testing over the range of conditions under which the system would operate. For example, on examination, sulphur hexafluoride would appear to be an appropriate surrogate for materials containing sulphur but it may not be appropriate for carbon based compounds. Its use in this manner would have to be validated carefully in a series of trial runs. The Board suggests that new surrogates (test materials) be fully tested and their performance reviewed with Alberta Environment before use.

The estimates of wastes to be treated in the future that are provided in the Bromley Report appear to include pentachlorophenol (PCP) contaminated materials from abandoned wood treatment plant sites identified by Alberta Environment's Help End Landfill Pollution (HELP) Program. Dr. Hrudey, on behalf of the Town of Swan Hills, suggested that incineration of PCP contaminated materials could produce relatively high concentrations of dioxins. Chem-Security said that existing protocols and operating conditions for chlorine containing wastes should be adequate for incineration of PCP containing materials but, if substantial quantities of such materials were received, a test burn program might be undertaken.

In view of the public concern about the toxicity of dioxins and furans which would be produced in the incineration of PCPs, the Board requires that the applicant conduct one or more test burns of PCP contaminated material from wood preserving plant sites when such material begins to arrive at the Centre. The objective of the test burn, or burns, would be to ensure that such material can be incinerated in a manner that will meet emission limits for dioxins and furans established by Alberta Environment in the applicant's licences and that risks to human health and the environment posed by its incineration are acceptable. Furthermore, the Board requires that Chem-Security not incinerate any waste of composition significantly outside the range of that being incinerated by the existing facility unless it has conducted test burns, reassessed probable emissions and their potential effects, discussed the results with Alberta Environment and made any changes to pre-treatment protocols for sampling and analysis, equipment and treatment processes that Alberta Environment may require.

7.1.5.3 Production of Toxic Substances in the Stack

Although equipment in the pollution control train is designed to remove pollutants, toxic substances can also be formed there. The type and quantity of substances formed depends on the operating conditions. Dioxins and furans and organometallic compounds are substances that may be produced and emitted, and which can engender risks to human health and the environment even when present in very low concentrations. Dr. Hrudey drew attention to the possible formation and emission of these substances.

Chem-Security stated that, based on experience at the Treatment Centre and at incinerators elsewhere, the production of dioxins and furans in the pollution control train can be reduced by operating most of the train at relatively low temperatures. Temperatures must not be too low lest concentrations of other contaminants are increased: there is an optimum temperature band for the best overall pollution control performance. The approximate range for optimum operation can be obtained from past experience, but more exact definition is difficult because the concentrations of dioxins and furans in the emitted flue gas are normally below detection limits. As in the case of PCBs, the applicant may be forced to depend on the monitoring of accumulation of dioxins and furans over a long period to detect unacceptable emission levels. This problem is discussed in section 7.4.

The Board agrees that it is possible to define at least a broad range of operating conditions that will reduce dioxin and furan production, but the same cannot be said for organometallic compounds. Such compounds do pose a potential health risk and, while they are destroyed by incineration, they can also be formed in stacks. The applicant has been able to obtain very little information about the formation and emission of such compounds.

The Board accepts that the applicant will take all appropriate steps to attempt to comply with the new emission limits for dioxins and furans recommended by Alberta Environment. The Board also recognizes the technical obstacles to meeting such a stringent target and to determining whether the target has in fact been met. The Board recommends that, if Chem-Security has difficulty in meeting the new emission licensed limit for dioxins and furans, or if long-term monitoring results show that their concentrations in environmental components are increasing unacceptably, Chem-Security, with the advice of Alberta Environment, initiate an experimental program to improve control of dioxin and furan emissions.

Organometallic emissions are clearly not understood. Because the formation of organometallic compounds in pollution control trains, if it occurs, is not likely to be confined to the Treatment Centre, the Board recommends that Chem-Security consult with other operators of waste incinerators with the object of sponsoring a joint investigation of the subject.

7.1.5.4 Planned Shutdowns

A concern was expressed at the hearing that emissions of potentially hazardous substances from the incinerator might be increased during planned shutdown and startup procedures when

the incinerator is operating below capacity. Chem-Security said that shortfall of waste would not normally lead to more frequent shutdowns because it is desirable to maintain the temperature of the incinerator at or near the operating range. This would be accomplished by supplemental fuel-firing. Low feed rates of waste would allow more flexibility in planning shutdowns. Planned shutdowns would involve a staged process beginning with cessation of waste input. All systems, including the pollution control system, would be maintained in operational condition as the incinerator is cooled. No waste would be burned in the hour preceding the beginning of a planned shutdown.

The Board concludes that planned shutdowns would not result in increased emissions if conducted in the manner described by the applicant.

7.1.6 Emergency Venting

During the operation of process machinery such as that employed at the Centre there are, and may be, occasions when operating conditions vary beyond the normal acceptable range. Engineers call these "process excursions". When a process excursion occurs, unusual actions may be required to protect the safety of workers and the plant. In the case of an incinerator, a severe process excursion could require emergency venting of gases and particulates directly from the incinerator to the atmosphere. Such occasions are more frequent when new equipment is being installed and tested, and less frequent or virtually non-existent when a plant is operating routinely under strict operating protocols. Chem-Security reported four to seven process excursions per year requiring emergency venting from the first incinerator at the existing plant and suggested that this number would not be exceeded with the new kiln in normal operation. There might be more emergency venting from the new kiln during its first year of operation as this had been the case for the second incinerator at the plant during its first year of operation. The maximum duration of any emergency venting episode was 20 minutes.

The applicant was unable to provide quantitative estimates of the contribution of emergency venting to total annual emissions. Interveners suggested that emission limits set by Alberta Environment as licence conditions may be exceeded during such episodes and that the contribution of emissions during emergency venting to the total annual emissions of some substances could be substantial.

Chem-Security confirmed that the ground-level particulate concentration limit may be exceeded once or twice a year and that the limit for hydrogen chloride may be exceeded for about one hour per year as a result of emergency venting. It argued that longer term average concentrations of contaminants and annual accumulations of contaminants are more significant in terms of health and environmental risk than are occasional exceedances of licence limits.

The Board made a rough comparison of the relative amounts of some pollutants that would be released during emergency venting episodes and during normal operations of the proposed incinerator. The results shown in Table 7-1 suggest that emergency venting of PCBs would account for a very small quantity in relation to normal stack emissions. However,

emergency venting of HCl would be of the same order of magnitude as total annual stack emissions and emergency venting of particulates would be roughly an order of magnitude greater than total annual stack emissions from normal operations. These rough calculations are the best estimates available to the Board of the relative contributions of emergency venting and normal operations to annual emissions from the proposed incinerator. They suggest that emergency venting could contribute a large part of the total annual emissions of some pollutants, especially those associated with particulates. The possibility exists that workers at the Treatment Centre may be exposed to relatively high concentrations of some contaminants during process excursions.

TABLE 7-1
ANNUAL EMISSIONS OF SELECTED POLLUTANTS FROM NORMAL OPERATIONS AND EMERGENCY VENTING (in kg)

	Normal Stack Emissions*		Emergency Venting**
	Mean	Mean + 3SD	
PCBs	1.26	3.67	0.073
HCl	201	802	361
Particulates	1,915	4,107	17,136

* Based on emission rates reported in Table A-9 of the EIA, assuming 250 operating days at 10 hrs/day.

** Based on data presented in Table 4-20 of the EIA, assuming seven 20-minute venting episodes per year.

Another unknown quantity is the composition of particulates released during emergency venting. Some contaminants that can accumulate in the environment and pose long-term health risks may be present in particulate emissions. Polycyclic aromatic hydrocarbons (PAH) are a class of such compounds. SHERC recommended that the applicant gather samples of particulates, analyze them to determine their composition, and estimate their contribution to the total contaminant load in the air and deposited on vegetation, soil and water. Chem-Security provided technical reasons to explain why this could not be done in a manner that would provide reliable estimates and pointed out that monitoring of the receiving media would detect any increases in deposition of contaminants whether or not they were carried on particles.

SHERC, in its written submission, recommended that:

> "The expansion be designed to ensure that emergency venting emissions are directed to pollution control equipment so that emission standards are never exceeded and the strictest controls be applied with respect to level of concern #1 toxics."

The applicant expressed the view that it would be difficult to vent emergency emissions to pollution control equipment unless a complete alternate pollution control train were to be kept in operational readiness while the kiln is active and that to do so would be prohibitively expensive. Neither SHERC nor Chem-Security could provide an example of an alternative pollution control system installed to accept emissions during emergency venting at a waste incinerator. In fact, SHERC identified the development of such a system as a business opportunity for Chem-Security.

The Board accepts that the monitoring of environmental receptors will provide early warning of increasing concentrations of some contaminants, specifically those elements and compounds that could accumulate in the environment and pose a chronic (i.e., long-term) health risk. However, it must also be recognized that monitoring of environmental receptors is incapable of detecting the transient increases in non-accumulating pollutants that occur during emergency venting episodes. Such unmeasured emissions could pose an acute (i.e., short-term) health risk. The Board believes that emissions occurring during process excursions could be a significant contributor to some acute and chronic risks to human health and the environment and that reducing their quantity is a desirable goal. The Board recommends that the applicant and Alberta Environment jointly review the causes of process excursions and the actions taken by operators in response to each event to determine whether operational procedures can be improved to limit the number and duration of emergency venting episodes in the future.

The Board notes that experience with other chemical processes suggests that it is the removal of the last 10 percent of impurities or pollutants from flue gases that is most difficult. It may be possible to design some less elaborate and less expensive equipment that could be used to accept gases vented in an emergency. For example, equipment used to precipitate particulates from the gases in the days before regulatory requirements became stringent may be worthy of examination. Simple equipment might remove as little as half of the particulates emitted and yet contribute significantly to lowering total annual emissions of some contaminants. The Board is not satisfied that the applicant has fully investigated this possibility. The Board recommends that the applicant further investigate the technical and economic feasibility of some form of pollution control of gases vented from the proposed incinerator expansion during an emergency and review its conclusions with Alberta Environment by December 31, 1992, with the objective of ensuring that the best practical technology is being applied.

With respect to the possibility of exposure of workers to relatively high concentrations of contaminants during process excursions, the Board recommends that the applicant consider the possibility of requiring workers not otherwise required to wear breathing masks to have immediate access to such equipment for use during emergency venting episodes.

7.1.7 Emissions from the Centre other than those from Incineration

7.1.7.1 Fugitive Emissions from Buildings

In the EIA, Chem-Security described how its monitoring program detected elevated concentrations of PCBs in red-backed voles living near the Centre. It was able to determine (see section 7.5.3.2) that the source of the PCB contamination was fugitive emissions from various parts of the Centre. Chlorobenzenes at relatively high concentrations and chlorophenols at relatively low concentrations were also present in the fugitive emissions. Estimated past rates of emission from the waste handling and waste storage buildings are reviewed in section 7.5.3.4.

Having detected the problem, Chem-Security developed a remedial program to reduce fugitive emissions. It has closed the transformer processing area and will close the transformer storage and cold storage buildings over the next two years. Carbon filtration systems will be installed for inside and exhaust air from the decant and heated storage buildings. Modifications will be also made to equipment and housekeeping methods on the organic tankfarm. The applicant projects a decrease of fugitive emissions of PCBs from 15 kg to 1.3 kg per year on completion of these measures. Similar order of magnitude declines are also expected for chlorobenzenes and chlorophenols. The effects on fugitive emissions of remedial measures to combat them are discussed in relation to overall emissions in section 7.5.3.4. The supply of PCBs to the Centre for treatment is expected to decline significantly and this could further decrease emissions.

Monitoring of PCBs in vole populations in 1991 showed further increases in whole body concentrations. In the opinion of the Board, this can be explained by the fact that few of the remedial measures came into effect until after the last sampling period. In addition, voles may continue to accumulate PCBs retained in vegetation and soils after emissions have been controlled. As discussed in section 7.5.3.4, declines in concentrations in vegetation and soil may take several years to become evident, even if incineration of PCBs is ended.

Concentrations of PCBs in environmental components are still low in comparison to acceptable levels and are not considered to present health or environmental risks. The Board is satisfied that the applicant's program to control fugitive emissions of organochlorine compounds including PCBs from the Centre is well-founded and that it should be effective if the new incinerator operates as proposed.

7.1.7.2 Fugitive Emissions from Transfer Stations

Waste is shipped from waste generators and clean-up sites to the Centre by road. Chem-Security operates transfer stations at Nisku and Calgary where full loads are assembled for shipment to Swan Hills. Because fugitive emissions from handling facilities at the Centre itself have been a concern, the potential for similar emissions from transfer stations needed

examination. Chem-Security observed that all transfer of wastes at transfer stations consists of movement of sealed drums or other closed containers. Therefore, no fugitive emissions are expected. The Board accepts this conclusion.

7.1.7.3 Resuspension of Dust

Dust may be formed in the vicinity of the Centre by the action of wind or human, animal or vehicular traffic on soil, roads and working surfaces. Excavation and construction can also be sources of large quantities of dust. Where the ground surface has been the recipient of deposited contaminants, the formation of dust can lead to the resuspension and further dispersion of contaminants. SHERC explained that its primary concern in relation to dust is not the total suspended particulate concentration, but the total concentration within the air of contaminants that may be hazardous to human health and the environment; the contaminants contained in the particles of resuspended dust contribute to these total concentrations.

SHERC recommended that:

> "An assessment be undertaken of the possible hazards posed by dust from contaminated soils disturbed during the construction and operational phases of the expansion, appropriate mitigative measures be undertaken, and fugitive dust emissions monitored."

Chem-Security said that it did not expect that large quantities of dust would be generated at the site during construction or operation of the proposed expansion. No site clearing or blasting would be required for construction. Approach roads and roads inside the Centre are paved; frozen ground in winter and relatively frequent rain in summer reduce dust generation. When conditions are dry during summer, the applicant intends to use dust suppression measures such as surface wetting. Monitoring has shown that, with the exception of emergency venting, exceedance of total suspended particulate concentration targets has occurred only when construction is in progress at the Centre. Data presented in the EIA show that additional concentrations of hazardous contaminants present and expected to be present in the soils and attributable to operation of the Centre are less than background levels. This means that the concentrations of the same substances in resuspended dust will be very low and certainly below the concentration limits for contaminants in air at ground-level recommended by Alberta Environment through its licensing process.

The Board accepts that although concentrations of potentially hazardous contaminants in the air are unlikely to exceed licensed limits even when dust is being generated by on-site construction total suspended particulates may do so at that time. The Board believes that there is no evidence to support the contention that deposition of resuspended dust will elevate soil contaminant concentrations to unacceptable levels. Resuspension and redeposition is likely to result in a lowering of concentrations of contaminants in the soil where they might otherwise be higher (near the Centre) and a slight increase in a larger area where they might otherwise be lower. In the Board's opinion this is acceptable.

In summary, the Board does not believe that resuspended dust is likely to give rise to unacceptable concentrations of contaminants in the air or the soil. However, the Board does recommend that the applicant carry out its intention, expressed at the hearing, to employ dust control measures when dust is being generated at the Treatment Centre because dust itself can be a hazard to health and safety.

7.1.7.4 Odours and Noise

No concerns were raised about odours or noise, and the Board saw no evidence to indicate that there is reason for any such concerns.

7.2 Dispersion of Emissions

Section 7.1 dealt with the emission of pollutants from the expanded Centre; this section deals with the dispersion of pollutants from the Centre and their arrival at receptors in the area surrounding it. In order to ensure that the Centre would meet licence requirements, the applicant employed mathematical modelling to determine expected ground-level concentrations of pollutants in the potentially impacted area. This information was also used to assist in estimating the deposition of contaminants on plants, soil and water.

7.2.1 Choice of Dispersion Models and Input Data

Chem-Security used a modified version of the United States Environmental Protection Agency Industrial Source Complex Short-Term (ISCST) model to estimate dispersion and ground-level concentrations of pollutants. The ISCST model is a generally accepted model for regulatory purposes and has been widely used. Input to the model includes emission source characteristics and meteorological data. The applicant selected the modified ISCST model after comparing its performance with that of Alberta Environment's Search for Extreme Ensemble Concentrations (SEEC) model. Although the two models provided similar results, the SEEC model is less powerful and less versatile. It does not have the ability to account for terrain effects and cannot provide output for locally differentiated sites within an impacted area.

The applicant's modification to the model enabled it to use meteorological data collected at the plant site rather than long-term data from the nearest Atmospheric Environment Service weather station at Edson. There are significant differences between these data sets, particularly with respect to atmospheric stability and turbulence. Chem-Security expressed the opinion that the use of site-specific data would be expected to improve the predictive capability of the model for the area concerned and that the opportunity to make such an improvement is both unusual and fortunate; not to use the site-specific data could have been considered negligent.

Nevertheless, some of the parameter values the applicant used to model mechanical and convective mixing of the plume were questioned at the hearing. Chem-Security assumed a low value for the "surface roughness" parameter although a higher value would normally be chosen because the canopy of the forest is broken in much of the impacted area. Increased surface

roughness could increase mechanical mixing which would tend to elevate ground-level pollutant concentrations. The applicant combined ground-level temperature data recorded at the Treatment Centre with upper air temperature data from the Stony Plain meteorological station to estimate seasonal and diurnal convective mixing heights. The values thus obtained were as much as an order of magnitude lower than previously published values for Stony Plain. Assuming too low a mixing height might lead to underestimation of ground-level pollutant concentrations. The applicant's consultant said that he had been surprised that the mixing height values obtained by using on-site data were rather low. Nevertheless they were used as input and the model performed well in predicting concentrations of sulphur dioxide and nitrogen oxides. It tended to overpredict the higher concentrations and evidently tends to err in an appropriately conservative direction in terms of the assessment of risk to human health and the environment.

The Board is satisfied that the applicant's choice of the modified ISCST model was appropriate and that the decision to use local data to characterize atmospheric turbulence insofar as this was possible was preferable to the alternative of using values measured elsewhere. The surface roughness and convective mixing height inputs to the dispersion model appear at face value to be unreasonable and apt to lead to underestimation of ground-level contaminant concentrations. However, the comparison of predicted and observed concentrations of sulphur and nitrogen oxides convinced the Board that the model as used by the applicant provides an adequate simulation of plume dispersion for the existing facility. The Board is also prepared to accept that the use of the modified ISCST dispersion model with the current inputs is an appropriate method of determining the design and regulatory requirements of the proposed expansion. However, the Board notes that the reasonable correspondence between pollutant concentrations observed at the existing facility and those predicted by the model does not guarantee that a similar level of concordance would be reached between observed and expected values after the expansion. In particular, the Board notes that the winter convective mixing heights provided in Figure A-4 of the application are below the proposed stack height. Under circumstances where the plume height exceeds the convective mixing height, the ISCST model will predict zero ground-level concentrations. Thus there is a concern that the model in its present form could potentially underestimate the pollutant concentrations that would be associated with the expanded Treatment Centre should mixing heights typically be higher than the applicant currently assumes. The Board recommends that Chem-Security conduct a further examination of the sensitivity of its modified ISCST model output to mixing height and, in particular, of what the effect of using the mixing height data available for Stony Plain would be on predicted ground-level contaminant concentrations. The results of the examination should be made available to Alberta Environment for consideration in the licensing of the proposed expansion with particular reference to the height of the stack.

7.2.2 Observed and Predicted Concentrations of Contaminants in Air

Chem-Security presented comparisons of observed concentrations of contaminants in ground-level air near the Centre during operation of the existing facility and concentrations predicted by the modified ISCST model. The Board reviewed this evidence and makes the following observations:

Predicted concentrations of sulphur and nitrogen oxides were higher than those observed, confirming the conservatism of the modified ISCST model's performance in terms of risk to human health and the environment. In the case of PCBs, predicted concentrations were higher except for about 8 percent of the days tested when PCB concentrations above 300 ng/m^3 were observed. These higher concentrations are explicable by fugitive emissions from handling facilities at the existing Centre. Although fugitive emissions were identified as a source in the modified ISCST model, the applicant substantially underestimated them in its initial projections. As discussed in section 7.1.7.1 of this report, steps have been taken or will be taken by the applicant to control them.

Observed concentrations of carbon monoxide at the applicant's monitoring station exceeded those predicted to occur as a result of emissions from the existing Centre. However, the maximum predicted concentration (one hour average) is 28 parts per billion (ppb) and the average background concentration from other sources is about 200 ppb. This is still well below Alberta's ambient one hour average air quality objective of 13,000 ppb. The applicant stated that local vehicular traffic is a large contributor to background carbon monoxide concentrations.

Observed concentrations of total suspended particulates also sometimes exceeded concentrations predicted to arise from emissions from the incinerators at the Centre, and by a large amount. This is because fugitive dust generated by construction activity and traffic contributes much more to total suspended particulates than do emissions from the Centre. The matter of fugitive dust is dealt with in section 7.1.7.3 of this report.

The Board's conclusion is that the modified ISCST model provides satisfactory estimates of concentrations in air of pollutants that originate from the existing Centre and that would originate from the expanded facility. The Board notes that the model tends to over-predict concentrations arising from emissions from the incinerators at the Centre and is therefore conservative from the point of view of estimated risk.

The maximum predicted ground-level contaminant concentrations for post-expansion operation are listed in the application along with, where possible, comparisons with the objective values defined by the Ontario Ministry of the Environment for ambient air quality. The objective ambient concentrations in all cases are greater than the predicted maxima, in some cases by as much as six orders of magnitude. The closest approach of the predicted values to the Ontario objectives are observed in the case of PCBs, total dioxins/furans, benzo(a&e)pyrene and lead. In the first case, the predicted 24-hour and annual values are about one-third that of the objectives. In the second and third cases, the annual values are about one-tenth that of the objectives and in the final case, the 24-hour value is about one-twentieth the value of the objective.

The Board concludes that, based on the available data, the ground-level concentrations of contaminants in air which would arise from the proposed expansion would generally meet regulatory objectives.

7.2.3 The Effect of the Building Wake During Emergency Venting

Building downwash effects were considered by Chem-Security and taken into account in its dispersion modelling. The Huber downwash influence is incorporated into the ISCST model. US EPA has recommended some recent revisions to the model which affect the treatment of building downwash. The applicant tested these for both the existing operation and the proposed expanded operation and found the new predicted ground-level concentrations of pollutants in both cases to be lower than those given by the earlier unrevised version of the model. The earlier version is therefore more conservative from the point of view of risk. The results of the modelling of building downwash led the applicant to increase the height of the stack in the proposed expanded facility.

SHERC was concerned that emergency venting during the incidence of a strong building downwash effect could give rise to very high levels of suspended particulates near the buildings. Particulates released during emergency venting might contain toxic contaminants. Because this did not appear to have been specifically addressed in the modelling of dispersion of emissions, SHERC suggested that the applicant review its modelling of the dispersion of emissions and locate equipment to monitor pollutants within the area that might be affected by the building wake. Chem-Security had considered and rejected the idea of placing monitors in the building wake because the short duration of emergency venting episodes and the unpredictability of wind direction are such that the long-term monitors used to sample suspended particulates and toxic contaminants present in low concentrations would be unlikely to detect the brief high concentrations that could occur. Such a station would be at or inside the Treatment Centre fence line. Monitoring on the site undertaken as part of the Occupational Health and Safety Program had not detected exceedances of concentration limits defined to protect workers.

The Board believes that further work to model concentrations of contaminants within the building downwash zone during emergency venting episodes would not be worthwhile. This does not mean that the Board believes the matter should be ignored. Although Alberta Occupational Health and Safety standards have been met and are likely to be met in the proposed expanded operation, concentrations of suspended particulates could rise to high levels near the Centre during emergency venting and the contaminant content of such particulates is not known with any certainty. The Board has concluded that rather than pursue further modelling, the applicant should address its attention to reducing the frequency of emergency venting and reducing the quantity of emissions during emergency venting episodes, The Board has made recommendations to this effect in section 7.1.6. While the Board generally accepts Chem-Security's reasoning with respect to the effectiveness of the placement of a monitoring station in an area that may be affected by building downwash, it recommends that the phenomenon be kept in mind by the applicant and Alberta Environment when reviewing the overall distribution of monitoring stations. The reason for this is to cover the unlikely eventuality that operating performance departs greatly from what is expected. If this were to occur, and the monitoring equipment were to detect such a departure, Alberta Environment could take action during its annual licence review.

7.3 Deposition of Emitted Pollutants

In order to estimate quantities of contaminants to be expected in environmental components as a result of operation of the proposed expanded Treatment Centre, the deposition of contaminants on vegetation, soil and water has to be considered. This can be done by the development and application of detailed deposition models for each contaminant or by the use of general information about deposition obtained from the scientific literature.

7.3.1 Deposition Modelling and Estimates of Deposition

Although Chem-Security did not build deposition models for use in the estimation of concentrations of contaminants in the environment, it did make limited use of Alberta Environment's Sulphur Deposition (1984) (SULDEP) model of sulphate deposition. This model was run 5 years ago in the early design stages of the existing Centre and the output was used to locate monitoring stations downwind of the Centre. The deposition zones reported in Figure 4-32 of the EIA are not consistent with the spatial distribution of ground-level concentrations of contaminants in air generated by the dispersion modelling. This was because the SULDEP model was run before site-specific meterological data were available whereas the dispersion modelling uses recent meterological data from the site. Monitoring station locations are being reviewed as more reliable information has become available, in particular information about prevailing wind direction and contaminant concentrations detected at existing monitoring stations.

Chem-Security used ground-level concentrations of contaminants in air predicted by the dispersion modelling and deposition velocities (i.e., the rates at which airborne pollutants are deposited) to estimate quantities of pollutants arriving at environmental receptors. The applicant did not conduct independent modelling of deposition, but relied on standard values reported in the literature and used in other jurisdictions such as the United States. Elsewhere in its evidence, the applicant indicated that it had relied on indirect evidence of deposition of pollutants assumed to have originated from the existing Centre to provide a crude check on its estimates of deposition. The indirect evidence is from analysis of vegetation, soil and water in the vicinity of the Treatment Centre as part of the ongoing monitoring program. This allows an estimate of what is being deposited and the rate or rates of deposition arising from current emissions. Although the check provided by monitoring observations is crude, it was effective in the case of PCBs and could be in other cases if estimates of deposition prove to be based on faulty assumptions.

The Indian First Nations and SHERC suggested that Chem-Security should conduct much more extensive sampling of wet and dry deposition of contaminants in the vicinity of the Centre to confirm the modelling and prediction of the pathways and concentrations of contaminants en route to human and environmental receptors. Both interveners said that this was necessary to increase their confidence in Chem-Security's risk assessment.

Because the SULDEP model results were only used to locate monitoring stations, and as the location of these stations is being reviewed and modified on the basis of the results of dispersion modelling and monitoring, the Board has no concerns about them.

The Board's analysis of the matter of deposition estimates is as follows: results of the dispersion modelling suggest that even the highest predicted ground-level concentrations of pollutants would not present an unacceptable acute health or environmental risk (see section 7.6.1.2). Long-term accumulation is a greater concern. Therefore, concentrations of pollutants in vegetation, soil and water are more important than those in air. Observational data are generally more reliable than those obtained by modelling or other inference. Therefore, the analytical data obtained through the monitoring program are both the most reliable and the most informative with respect to deposition and, most importantly, to risks. In the case of PCBs, analytical data from the monitoring program have already been shown to be more reliable than projections based on models and assumptions about facility performance. It has also been shown to provide early enough warning of the need to remedy deficiencies in operating performance. On this view, the reliability of estimates of deposition undertaken on behalf of the applicant are of less concern than the adequacy of the design and execution of the monitoring program. Nevertheless, estimates of deposition are important as input to the assessment of risk. The Board accepts that Chem-Security used methods to arrive at its estimates of rates of deposition of pollutants that are generally accepted in other jurisdictions and, through peer review, in the scientific community. The Board finds this practice satisfactory.

7.3.2 Choice of Dependent Variables

In modelling dispersion and estimating deposition of contaminants, the applicant paid greater attention to common pollutants such as combustion gases than to toxic substances that pose long-term risks, such as those on the Ontario level of concern 1 list. SHERC put forward the view that the contaminants that accumulate in the environment and pose long-term health risks are of greater concern than the larger volume gaseous contaminants. It recommended that more effort be applied to estimating deposition of these substances and that: "Periodic monitoring be performed for Level of Concern #1 contaminants in the air and soil in areas where the maximum concentrations are expected to occur".

It is difficult to detect the organic compounds among the level of concern 1 list at the low concentrations present in the flue gases and subsequently as pollutants in air in the vicinity of the Centre. Validation of dispersion models is very difficult under these circumstances because only long-term monitors designed to accumulate pollutants over a lengthy period are capable of gathering enough pollutant for analytical purposes. Chem-Security did analyze PCBs in high volume air samples taken over 24-hour periods every 6 days, but it did not conduct similar sampling for other specific organic pollutants. Vegetation and soil are acting as long-term receptors and, to some extent, as accumulators of pollutants. Concentrations of pollutants in these receptors provide better information about their deposition and are more indicative of levels of risk to human health and the environment than are the very low concentrations present in air. The applicant did analyze environmental receptors for many contaminants likely to occur

at low concentrations. Most organic contaminants, with the exception of PCBs, were present, if at all, in concentrations below detection limits. Dioxins and furans were detected in samples of Labrador tea leaves at two sites near the Treatment Centre and a control site. One value of 130 picograms/gram (pg/g) was higher than the concentration at the control site, but it is considered a low value probably representing background concentrations which vary considerably because of contributions from forest fires.

The Board recognizes that the difficulty of detecting contaminants at low concentrations in the air and in environmental components makes direct verification of the rates of deposition of such substances impossible. Periodic analysis of receptors and of passive samplers exposed for long periods, and allowance for known rates of retention and depuration, appears to be the only practical approach to determining rates of deposition. An effective monitoring program can detect when, and if, the rate of accumulation accelerates and remedial action is required. As set out in section 7.1.1, the Board recommends that the applicant and Alberta Environment take into account the possibility that more attention may need to be paid to contaminants that may be emitted in small quantities but which may accumulate in the environment when conducting annual reviews of the design of monitoring programs.

7.4 Cumulative Emissions and Cumulative Deposition

7.4.1 Operating Life of the Centre and Cumulative Deposition

In the EIA, calculations of deposition and accumulation of contaminants in vegetation and soil and, subsequently, of risks to human health and the environment are based on the continuation of projected rates of emission for 20 years. The applicant has assumed that after 20 years there would be no further accumulation of contaminants in vegetation, soil and water and that people, and environmental components, would be exposed to the maximum concentrations reached during the 20-year period of operation throughout their expected life of 70 years. The question arises of whether continuation of operation beyond that 20-year period would result in higher concentrations of contaminants in the environment and, if so, what would be the effect on the assessment of health risks.

The applicant argued that doubling the assumed period of operation would not result in a significant increase in risks to human health and the environment unless fugitive emissions of toxic organic compounds continued unabated. The risks arising from long-term accumulation of contaminants in environmental components, assuming that fugitive emissions are controlled, are estimated by Chem-Security to be so low that a manyfold increase in the period of operation would be required to generate risks near to the margin of what is normally considered acceptable. This analysis by the applicant carries the unstated assumption that the composition of the waste stream being treated would remain within the range treated at the Centre to date. Both the applicant and Alberta Environment consider it unlikely that the expansion would operate in its proposed form for as long as five years and certainly not for 20 years. What emissions

and deposition levels might be after, say, five years of operation is uncertain, but the implication of possible advances in technology is that rates of deposition would decrease rather than increase.

The Board accepts that improvements in technology may be made and recognizes that there is considerable uncertainty about what might happen 20 years in the future. However, the Board does not consider it appropriate to simply assume that improvements will be made and that emissions would decrease. The Board recognizes that if changes to the Centre that could alter the rate and volume of emissions were to be proposed, these would be reviewed by Alberta Environment as part of the licensing and regulatory process. The Board considers this an acceptable safeguard of the public interest with respect to equipment modifications. With respect to the period of operation, the Board believes that there is a possibility that the Centre could continue to operate in existing or modified form for more than 20 years. The Board believes that the monitoring program, put in place by the applicant and annually reviewed and approved by Alberta Environment, would detect any increasing accumulation of contaminants in the various environmental components before they reach levels that engender unacceptable risks to human health and the environment. If such detection were to occur, Alberta Environment would be able to require action to reduce emissions and deposition or, in the extreme case, curtail operations. The Board considers that should the expanded Centre operate for more than 20 years, Alberta Environment would be able to ensure that human health and the environment are not subjected to unacceptable risks. Furthermore, the Board has recommended in sections 7.1.5.2 and 7.8 appropriate action should the composition of the waste stream be changed.

7.4.2 Cumulative Emissions from All Regional Sources

Chem-Security provided an assessment of the effects of cumulative emissions from regional sources on air quality. This was done by compiling an inventory of stationary emission sources, estimating maximum emission rates and modelling air quality assuming that maximum emission rates occur daily throughout the year. According to the application, there are five oil batteries within 10 km of the Centre, three to the west, one to the north and one about 8 km to the northeast. The latter is the only industrial source to the east of the Centre and within 50 km of it. Within 25 km of the Centre and virtually all in a segment of the compass running from southwest via west to north are a further 47 oil batteries, 7 compressor stations and 2 sour gas plants. Within 50 km of the Centre and in the same segment are an additional 36 oil batteries, 18 compressor stations and 6 sour gas plants. In oral evidence, Chem-Security noted the presence of other industrial operations more than 50 km from the Treatment Centre including sawdust burners at mills along the south shore of Lesser Slave Lake.

The applicant examined regional air quality as exemplified by concentrations of sulphur dioxide, oxides of nitrogen, carbon monoxide, total hydrocarbons, total suspended particulates and PCBs predicted by dispersion modelling to arise from the maximum rate of emission from the Centre. A review of the source inventory and of ambient air quality data showed that regional industrial sources contributed measurably to sulphur dioxide concentrations near the Centre, but not significantly to concentrations of nitrogen oxides, total hydrocarbons, or PCBs.

Local sources of carbon monoxide and TSPs do contribute significantly to concentrations observed near the Centre. The combination of maximum predicted concentrations attributable to predicted emissions from the proposed expanded Centre and maximum concentrations from regional sources is not sufficient to exceed Alberta's air quality objectives for any of the pollutants mentioned above, except when dust is generated by construction and TSP levels consequently exceed objectives. The applicant suggested that it is unlikely that air quality objectives would be exceeded in the region generally, except perhaps very close to some point sources of particular emissions.

In the regional context the existing and proposed expanded Centre would be small contributors of emissions to the atmosphere. According to the applicant, SO_2 emissions would be less than 2 percent of those from a single large sour gas plant. NO_x emissions would be less than 10 percent of those from a large power plant.

The Indian First Nations expressed concern that they and other residents of the communities along the south shore of Lesser Slave Lake are being exposed to atmospheric pollutants that may be harmful to them, although they acknowledged that the contributions of the existing and proposed expanded Treatment Centre to that exposure are, and probably would be, small.

The Board concludes, from the fact that regional air quality is generally within the objectives that are considered acceptable by Alberta and in other jurisdictions, that cumulative emissions are not giving rise to unacceptable risks to human health and the environment. The Board accepts that the contribution of the proposed expansion of the Treatment Centre to regional air quality would be unlikely to cause any of the generally accepted parameters of air quality to exceed regulatory targets with the possible exception of the generation of dust during construction. The Board considers that this performance would be acceptable, provided dust suppression measures as required in section 7.1.7.3 were to be employed.

The Board has not made a detailed study of air quality in the communities along the south shore of Lesser Slave Lake, but the evidence before it suggests that local sources would have by far the greatest influence on air quality in those communities. The contribution of air pollutants from the proposed expanded Treatment Centre to total concentrations in the communities would be negligible and probably undetectable. The operators of local sources that do significantly affect air quality in the communities are not parties to the application before the Board.

7.5 Concentrations of Contaminants in the Environment

Two kinds of information about concentrations of contaminants in the environment were provided by the applicant: direct observations obtained by analysis of samples from the vicinity of the Centre or, in the case of some background levels, from elsewhere, and estimates of concentrations using maximum emission rates and other conservative assumptions. The estimates were prepared by modelling the movement of contaminants along environmental

pathways as part of the health risk assessment. The direct observations from the area around the Centre were obtained through the monitoring program. Direct observations are discussed in section 7.5.1 and estimates in section 7.5.2. Because of the importance of chlorinated hydrocarbons as contaminants that may accumulate in the environment, they are dealt with separately in section 7.5.3.

7.5.1 Direct Observations

Chem-Security has undertaken an extensive program of sampling and analysis of environmental components in the vicinity of the Centre both before operation began and during operation of the existing Centre as part of its monitoring program. This is intended to continue during operation of the proposed expanded Centre. Surface and groundwater, soils, vegetation, fish and wildlife have been and would be analyzed for many elements and compounds. Pollutants emitted from the Centre in relatively larger quantities can be detected in the environment but those emitted in small amounts may be present in the environment at concentrations undetectable by analytical methods currently available. As a result, the analyses include more inorganic substances which are present naturally at measurable concentrations and less organic pollutants, most of which are not. Most of the elements and compounds emitted by the Centre occur naturally in concentrations that vary considerably. This can make determination of the contribution from emissions difficult.

In this section, the Board views evidence of the extent of the analytical program for each environmental component as well as with the detection of higher than expected concentrations of contaminants. Chem-Security stated that most analytical results were within the normal range expected in Alberta and were not high enough to cause unacceptable risks to human health or the environment. Three kinds of departures from expectation were detected in the analytical data:

- sporadic high concentrations of a particular contaminant at a particular location;
- positive correlations of concentrations of contaminants observed in the environment with concentrations predicted by dispersion and deposition modelling of pollutants emitted from the Centre; and
- concentrations of contaminants increasing with time.

In the Board's opinion, the latter two categories should be investigated in greater detail.

7.5.1.1 Surface Water

According to the evidence of Chem-Security, surface water quality has been monitored at 10 stations. One is a control located in a watershed that does not receive runoff from the vicinity of the Centre; two are upstream of the Centre and two are at the surface water ditches that intercept runoff from the site. The rest are downstream. Samples are taken in April,

August/September and October. Values of a total of 48 parameters of water quality were determined for each sample. Some samples were analyzed for organic priority pollutants on the US EPA (1982) list, but none of these were detected.

Although there were variations in concentration of nitrates, dissolved oxygen and phenols over time at some of the sampling stations, the applicant provided convincing explanations that these were unrelated to activities at the Centre. Some changes were related to impoundment of water by beaver, some were regional in extent, occurring at the control stations as well as the others, and some were sporadic and did not show correlation with the expected spatial pattern of effect of the Centre.

There is no evidence before the Board that the Coutts River system, which receives runoff from the area around the plant site and areas downwind of the Centre, is a source of drinking water for human consumption. Nevertheless, the Board has assessed the water quality at the monitoring stations by comparing the observed data with the Canadian Drinking Water Quality Guidelines. As a result of the comparison, the Board notes that turbidity, apparent colour, iron, and manganese exceed the Drinking Water Guidelines. However, colour and turbidity can normally be brought to drinking water standards via treatment, and surface water quality often does not meet these criteria prior to treatment. In the case of iron and manganese, the Guidelines identify only aesthetic objectives. The presence of iron and manganese in water primarily represents a nuisance factor because it causes the staining of fixtures and laundry. Potable water treatment facilities have the ability to lower iron and manganese concentrations. Phenol and aluminum concentrations are higher than recommended for aquatic life, but there is no reason to suspect that these values were related to the operation of the Treatment Centre.

The Board is satisfied that the applicant's monitoring and analytical program provides reliable information about water quality in the area that may be affected by the proposed expanded Centre. For all six analyses where those results show somewhat elevated levels, the baseline data show the same characteristics as the overall data set, indicating that the conditions existed prior to the building of the Treatment Centre. The Board therefore concludes that water quality in the vicinity of the existing Centre generally meets Drinking Water Quality Guidelines and has not been adversely affected by operations to date.

7.5.1.2 Groundwater

Chem-Security stated that in 1984-85, it installed 24 stainless steel monitors and 19 piezometers at 10 locations around what would become the Centre. An additional shallow monitor was added in 1986 in an area of undisturbed peat near the Centre. In 1990, monitors were installed at three additional sites near the landfill area. Three horizons were sampled: a shallow zone up to 5 m in depth; an intermediate zone 4 to 10 m below ground-level; and the sandstone bedrock at 60 to 70 m below ground. Locations selected were near the Centre because the primary objective was to detect leakage or contaminated drainage from the site.

The Board examined data provided in the EIA and concluded that shallow and medium depth groundwater in the till layer at distances of more than 100 m from the site would have to be contaminated from surface water rather than by groundwater flow if contamination were to be detected within 1,000 years. Clearly, the source of contamination would be detected in surface water first. In the sandstone bedrock, Chem-Security reported groundwater velocities up to 320 m/year, but vertical flow through the till overlying the sandstone is very slow. The potential for contamination of the aquifer in the sandstone, other than by leaks from the injection well or vertical flow around the monitoring wells, if they are improperly completed, is very small. The potential for leaks from the injection well has been recognized by the applicant and preventive measures taken. These preventive measures and the proper sealing of the system at decommissioning are addressed in sections 9 and 13.3.

Groundwater samples were collected by Chem-Security in February, May, August and October. Samples were analyzed routinely for 42 parameters. Additional samples collected in August/September were analyzed for total extractable hydrocarbons, halogenated organics, nitrogen-phosphorus compounds and total volatile organics. Some samples were analyzed for organic pollutants on the US EPA (1982) list.

The applicant detected a number of variations in the values of inorganic parameters of groundwater quality between 1985 and 1991. Changes in calcium, bicarbonate, conductivity, hardness and alkalinity in two shallow monitors were attributable to a reversal in the vertical direction of flow caused by construction at the plant site. Small changes in sodium, chloride and sulphate in the sandstone layer were attributable to the use of the aquifer as a water supply source. Other changes in concentrations of inorganics showed no consistent patterns and did not appear to be related to plant activities. Analyses of trace organics were generally negative or showed the presence of compounds usually introduced to samples by handling or by analytical equipment. In 1990, a tributyl ester of phosphoric acid was detected in one sample; and Chem-Security acknowledged that it could be a contaminant if it is detected in subsequent samples. A Board recommendation with respect to this matter is made in section 7.5.1.3.

The Board is satisfied that sampling and analytical methods and the selection of parameters in the applicant's monitoring program are appropriate and that the results provided by the program are representative. The Board has reviewed those results and other evidence about contaminants in groundwater and concluded that there is no reason to believe that the Centre had given rise to groundwater contamination by the end of 1990.

7.5.1.3 Aquatic Resources

Chem-Security provided evidence of its monitoring of the Coutts River system near and downstream of the Centre. In 1985, samples were taken from 4 sites and in 1986 this was increased to 7, although until 1990, samples from the additional 3 sites were archived. Sediment, benthic invertebrates and fish were sampled at stream sites and fish were taken from Chrystina Lake. Concentrations in sediment of 36 inorganic elements and the hazardous organic compounds on the US EPA (1982) list were determined. Muscle and skin of brook trout from

Chrystina Lake were analyzed for the same hazardous organic compounds and for 34 inorganic elements. Benthic invertebrates were identified to broad taxonomic groups (mayflies, caddisflies, stoneflies, midges, flies and others) and by trophic level (carnivores, herbivores, detritivores, detritivore/herbivores, carnivores/detritivores, and omnivores).

The analyses of sediment samples taken, before and after operation of the existing Centre began, show large variations in the concentrations of inorganic chemicals. These variations are greater than any temporal trends displayed by the sediment data. Organic analyses also showed large variations in the identity and concentration of substances detected. Most of the compounds detected were those usually found among the decomposition products of vegetation. Sulfolane, detected at one site, was attributed by the applicant to emissions from a sour gas plant in which it is typically present. It is unlikely to be produced by the Treatment Centre. Tributyl phosphate was detected at three sites in 1990. As noted in section 7.5.1.2, it was also detected at one groundwater station. Neither halogenated, nitrogen-based, nor phosphorus-based organic compounds were detected.

Muscle and skin tissue from several age classes of brook trout taken from Chrystina Lake each year and a composite sample of tissue from 5 white suckers taken from the same lake in 1990 were analyzed. Concentrations of inorganic chemicals in fish tissues varied considerably from year-to-year. For example, mercury concentrations were below the Canadian Food and Drug Directorate Guideline for human consumption of fish in 1988, increased in the older fish to above it in 1989, but decreased again to well below it in 1990. There appeared to be no correlation with activity at the Treatment Centre; the concentration of mercury in emissions from the Centre would not have been enough to account for a change of that magnitude. Natural changes in water and sediment chemistry often related to weather give rise to fluctuations in mercury concentrations and, because of methylation and demethylation (section 7.5.1.4), to its bioavailability. This could account for the observed variations. Concentrations of inorganics in white sucker samples did not show any unusual values.

In 1985, 4 nitro-phenol and pentachlorophenol, substances on the US EPA (1982) list, were detected in the muscle and skin tissue of one age class of brook trout. The source of these contaminants is unknown and they were not detected in subsequent years. None of the contaminants on the US EPA list, other than PCBs (see section 7.5.3), has been detected in fish tissue since operations began.

Chem-Security's data on the number, taxonomic grouping and tropic level of benthic invertebrates sampled at each site in each year can be used to detect changes in stream or lake ecology. Ecological changes may be explained by natural events, by the continuation of natural processes, or by disturbances, including that brought about by pollution. The benthic communities present in the streams were described by the applicant as typical of those of natural headwater streams within the sub-foothills regions of Alberta. Observed changes in these communities were consistent with what would be expected to occur naturally following activity by beaver. Chem-Security reported that beaver were active in the streams.

The Board has reviewed all of the evidence about concentrations of contaminants in aquatic sediments, benthic invertebrates and fish that the applicant has provided and is satisfied that the explanations of the observations offered by the applicant are well-reasoned and justified. The Board finds no reason to believe that aquatic resources have been contaminated by the existing Centre, but as mentioned in section 7.5.1.2, it recommends that the applicant and Alberta Environment review the matter if tributyl phosphate continues to be detected in sediments or groundwater.

7.5.1.4 Methylation and Demethylation Rates in Surface Water

The possible impact of emissions from the facility on methylation/demethylation rates in Chrystina Lake was raised by SHERC which recommended that these rates be recorded to establish background rates. The consequence of methylation rests in the conversion of metals (such as mercury), with relatively low toxicity, to organometallic compounds which are much more toxic because they are more readily assimilated and metabolized by living organisms. Chem-Security stated that the potential magnitude of such an effect would be minimal and difficult to detect relative to the many natural factors affecting this process. Brook trout is an aquatic carnivore, the type of organism in which one might expect increased mercury levels from high methylation rates to be largest due to biomagnification. Current monitoring of brook trout taken from Chrystina Lake has not shown any consistent elevation of mercury attributable to other than natural variation. Consequently, there is no current indication of an impact of operation of the Centre on methylation/demethylation rates in surrounding waters.

The Board accepts the evidence provided by the applicant that the existing Centre has not affected methylation and demethylation rates in surface waters.

7.5.1.5 Soils

According to Chem-Security, locations of soil sampling plots were based on results of the SULDEP plume dispersion model. Three deposition zones were defined by predicted rates of sulphate deposition. Within each deposition zone, the three dominant ecosite types were identified and five sample plots were established in each. Only two ecosite types were represented in the zone of heaviest sulphate deposition so the total number of sample plots is 40. In baseline sampling, all plots were sampled, but the sampling after the plant began to operate included only soil samples from the black spruce/Labrador tea/feathermoss ecosites in all three deposition zones and the lodgepole pine-black spruce ecosite in the zone of heaviest deposition.

Analyses of 38 soil parameters were carried out on samples from all plots. At each plot, soil from 0 to 5, 5 to 15, 15 to 30, 30 to 60 and 60 to 100 cm depth intervals was sampled. At lodgepole pine/black spruce plots the litter layer was sampled and at black spruce dominated sites the live moss and "fibric" (decaying moss) layers at the surface were sampled. Additional samples from the plots were analyzed for 18 organochlorine compounds listed as priority pollutants by the US EPA and 31 naturally occurring organics identified by gas chromatography and mass spectrometry.

The applicant stated that the results of baseline analyses were normal for acid soils in the boreal forest ecosystem, although high concentrations of cyanide were found and aluminum, cobalt, iron, titanium and vanadium were above the normal range in the black spruce/sedge-cloudberry/*Sphagnum* ecosite. Subsequent analyses undertaken as part of the monitoring program showed minor year-to-year and site-to-site variations in the parameters mentioned above and in potassium, lead, nickel and magnesium all in the lodgepole pine-black spruce ecosite. None of these could be correlated with emissions from the Centre. No PCBs, pesticides or priority organic pollutants on the US EPA list were detected in soils. However, after the detection of trace amounts of PCBs in foliage in 1989, live moss samples from the ground surface and decaying moss from the fibre layer beneath were re-analyzed using a more sensitive method. The results are discussed in section 7.5.3.1.

There is considerable variation in the soil analytical data and the Board believes it is important to establish that the data did not demonstrate increasing concentrations of contaminants, such as lead, that are generally accepted to pose significant risks to human health at low exposures. For example, it could be argued that lead concentrations reported in the EIA and in the supplementary information show an evident increase with time. However, a number of sources of variation must be confounded before this conclusion is reached. "Confounding" is used by statisticians to mean the elimination, by observational or experimental design and analytical methods, of sources of variation influencing a variable under study. Its purpose is to isolate the influence of a single source of variation so that the relationship between it and the variable under study can be examined free of the influence of, and interaction with, other sources of variation. In this case, Chem-Security pointed out that monitoring samples are not true replicates because exactly the same soil cannot be sampled each year. The exact location of the sample varies by a few metres from year-to-year. Within site variation is quite high, as can be deduced by year-to-year decreases at some sites. The applicant argued that changes in lead concentrations were not significant when these contributions to variation were taken into account. Furthermore, lead concentrations are not correlated with the expected pattern of deposition from emissions from the Treatment Centre.

The Board accepts the applicant's explanation of the concentrations of lead observed in soils. In addition, the Board is aware that calendar year variation in precipitation, runoff, temperature, plant growing season and plant production can affect soil chemistry greatly and differ from site-to-site. Taking these largely confounded sources of variation into account, it is impossible to conclude that lead levels have increased significantly. The applicant suggests that an increase to concentrations above the natural range would be sufficient to cause alarm and initiate remedial measures. All the concentrations reported in the EIA and supplementary information are within the natural range. However, the Board is concerned that ignoring a significant rising trend in concentration of a contaminant until values observed exceed the natural range could unnecessarily delay reaction.

The Board has reviewed all of the information on concentrations of contaminants in soils provided by the applicant and concluded that these reported concentrations, with the exception of PCBs which are discussed in section 7.5.3, do not indicate cause for concern. In section

7.6.3, the Board recommends that if a statistically significant increase in concentration of any contaminant in any environmental component over a period of 3 or more years is detected, the matter be brought to the attention of Alberta Environment and any need for remedial action be discussed as part of the annual licence review.

7.5.1.6 Vegetation

As described by the applicant, the vegetation in the area around the Treatment Centre is a typical boreal forest mosaic. Vegetation on upland sites is subject to disturbance by fire and, more recently, by logging. Several of the older clearcuts near the plant have been planted with lodgepole pine seedings. During field work undertaken over a five-year period, the applicant's consultants found no rare plants in the area.

Chem-Security established a multi-faceted vegetation monitoring program to establish conditions before operation of the Centre and to monitor conditions during operations. Sample plots were located at the same sites as those for soils described in section 7.5.1.5, that is in the most abundant vegetation types present in each of the deposition zones defined by means of the SULDEP model. Data assembled included:

- information about the health and vigour of plants, which was intended to provide an assessment of stress;
- the ground cover of understorey vegetation;
- foliage chemistry;
- health and growth of lichens; and
- chemistry of moss tissues exposed in "moss bags".

Lichen and moss bag sampling was undertaken at additional sites within the vicinity of the Treatment Centre. Eight to 10 sites were sampled within each deposition zone making a total of 23 lichen sites and 27 moss bag sites.

Samples of foliage taken annually from black spruce, lodgepole pine and Labrador tea were analyzed for 32 substances. During the 1988-90 observational period for which the applicant reported results, concentrations of sulphur and nitrogen increased. In some samples, the increases brought concentrations to above what the applicant considers normal ranges in Western Canada. The pattern of increased concentration was not related to the predicted pattern of dispersion and deposition of contaminants from the Centre. The applicant also found increases in cyanide concentrations in foliage, but was able to determine that these were false readings caused by deficiencies in the analytical method used. There were some increases in concentrations of potassium, calcium, iron, zinc and phenol, but concentrations remained within the natural range and were not related to the predicted pattern of deposition. The increases were considered by the applicant to be of no significance.

Detection of PCBs in vegetation near the Centre led the applicant to collect and analyze foliage for dioxins and furans. Concentrations of 130 pg/g and 11 pg/g were found in leaves

collected at two points near the Centre. At a control plot 3 km to the northwest, the concentration was 16 pg/g. According to the applicant, dioxins and furans may be produced by combustion of untreated wood, for example in forest fires. They are thought to enter plants through deposition of dust on the plant's surface rather than by absorption through root systems. The concentrations detected are considered very low and probably representative of background concentrations. Such low concentrations of dioxins and furans are unlikely to have significant effects.

Lichens are accepted by biologists to be more sensitive to atmospheric pollution than vascular plants and, as a result, have often been used as a method of detecting pollution and assessing its severity. Their sensitivity can provide an early warning system. The applicant has sought to take advantage of this by monitoring the apparent health and the growth rates of the lichen *Hypogymnia physodes* on tree boles in the area surrounding the Centre. By the end of 1990, no signs of damage, loss of vigour or decrease in growth rate had been detected.

The use of movable bags filled with *Sphagnum* moss to sample deposition of airborne contaminants is commonplace. Ions are readily absorbed onto the moss cells, even after death, and particulates are trapped by the much branched, leafy moss shoots. Moss from bags exposed in the area around the Centre, in winter and summer, from 1987 to 1990, was analyzed by the applicant and compared with moss from bags kept unexposed for the same periods. Cadmium, copper, chromium, iron, mercury, manganese, nickel, lead, sulphur, tin and zinc were assessed. The applicant noted that there were some variations in concentrations of zinc and cadmium, but these were not related to the expected pattern of emissions from the Treatment Centre. Mercury concentrations declined compared to the unexposed bag levels and this was attributed to leaching by precipitation. The applicant also sampled the naturally occurring moss layer at the ground surface as part of the soil analysis. Results from analysis of moss samples are discussed in section 7.5.1.5.

The Board has reviewed all of the information provided by the applicant that reports concentrations of contaminants in vegetation. With the exception of PCBs, dioxins and furans, the Board concludes that the levels observed are acceptable and that there have been no significant increases in concentration attributable to operations of the Treatment Centre. The detection of dioxins and furans is naturally a matter of interest to the Board, but the concentrations detected could well be attributable to natural sources. The Board notes that the applicant intends to conduct further analyses for these substances and is aware that the results will be reviewed with Alberta Environment. The Board is confident that Alberta Environment would require any necessary action should concentrations be found that identify the Treatment Centre as a significant source. PCB concentrations are discussed further in section 7.5.3.

7.5.1.7 Terrestrial Animals

The applicant reports the occurrence of 41 species of mammals, 154 species of birds and 4 species of amphibians in the vicinity of the Treatment Centre. No rare or endangered species of higher animals have been found near the Centre, but the Great Grey Owl is known to occur

in the Swan Hills. It has not been seen near the Centre. The applicant estimated population densities of moose, white-tailed and mule deer near the Centre by means of pellet group counts and reported estimates of densities of grizzly and black bears from the literature. Abundance of furbearers was described from trapping returns. Qualitative or anecdotal information was provided about other species. The numerical data on moose, the two species of deer and the two species of bear provides a baseline for comparison with future surveys.

For the purpose of more detailed analysis of contaminants in animals, the applicant selected an indicator species. The criteria for selection were as follows:

- are year-round residents;
- are relatively abundant;
- have high reproductive rates;
- are widely distributed for replicated sampling and measurements;
- have a defined and relatively small home range and maintain a moderate to high degree of home range residency;
- are conducive to systematic measurement and sampling;
- are subject to previous scientific investigations in published literature; and
- are practical for the implementation of a cost-effective monitoring program.

Gapper's red-backed vole was selected as the subject species for the systematic monitoring program. After PCBs were detected in the tissues of vole; additional samples of vole, deer mouse, dusky shrew, ruffed grouse and spruce grouse from the vicinity of the Treatment Centre were analyzed for those substances as part of a supplementary analytical program.

The applicant sampled red-backed voles twice a year in each of the ecosites in each of the deposition zones described in the soil and vegetation sampling sections. The applicant stated that variations in numbers in the vole population revealed by trapping were explicable by the typical short-term demographic cycle of small mammals and by differences between ecosite types. Variations in numbers were not related to deposition zone and did not differ significantly before and after commencement of operations at the Centre.

Whole body tissues of red-backed voles were analyzed for 5 macronutrients, 7 micronutrients, 15 inorganic trace constituents and 3 organic trace constituents. Most chemicals remained in concentration ranges observed before operation of the Centre began. Lead, titanium and tungsten showed sporadic higher values in the samples near the Centre and in the distant control sites, but these were not consistent from one monitoring period to the next. Arsenic and PCBs did show higher values after operations began. Although arsenic concentrations were higher after operations began than before, they were inconsistent from one sampling session to the next and showed no spatial pattern of the type that would be expected if emissions from the Centre had been responsible. PCB concentrations were correlated with the expected pattern of deposition of contaminants emitted from the Centre.

The Board has reviewed Chem-Security's evidence about the animal populations resident in the vicinity of the Centre and sees no reason to doubt its accuracy. The applicant's explanation of variations in numbers of red-backed voles is reasonable and justified. The Board has reviewed all of the analytical data on contaminants in voles provided by the applicant and concludes that, with the exception of the observed concentrations of PCBs, there is no reason to believe that the existing operation is causing contamination. The PCB concentrations are discussed in section 7.5.3.

7.5.2 Estimates of Concentrations Obtained by Modelling

Current observations of concentrations of contaminants in the various environmental components tell us about the effects of the existing Centre, but in order to assess potential effects of the expanded Centre it is necessary to know what these concentrations are likely to be after an extended period of operation of the expanded Centre. Chem-Security provided estimates of average concentrations of contaminants in air at ground-level at the Treatment Centre, at the Town of Swan Hills and at Chrystina Lake for background conditions, existing conditions and as they might be during operation of the expanded Centre. In addition, Chem-Security estimated the contributions of background, the existing Treatment Centre and the proposed expanded Centre to the deposition of contaminants from the air and used that information to predict contaminant accumulations in the soil over a twenty year period for all three locations. In the case of most contaminants, the expansion of the Treatment Centre would result in lower air and soil concentrations at the source accompanied by marginal increases in air and soil concentrations at the two remote locations. This pattern is largely attributable to the increase in stack heights proposed for the expansion. Because the analyses discussed in section 7.5.1 showed no significant increases in concentration of contaminants with time that were correlated with the expected pattern of dispersion of emissions from the Centre, the applicant argued that the lower future concentrations would be unlikely to result in increasing concentrations of contaminants in environmental components. PCBs, which are discussed in section 7.5.3, were an exception. Notwithstanding its conclusion, the applicant proceeded to produce estimates of concentrations of contaminants that might be reached in various environmental components after 20 years of operation of the proposed expanded Centre. These were based on conservative assumptions and used for input into the assessment of risks to human health and the environment.

As discussed in section 7.1.1, the applicant estimated ground-level concentrations of contaminants in air in the area around the plant by means of dispersion models. The predicted annual average ground-level concentrations after the expansion would exceed background levels for antimony at all three locations, for chlorobenzenes and PCBs at the Treatment Centre and Chrystina Lake and for total dioxins and furans at the Treatment Centre. The contributions of the proposed expanded Centre are expected to be less than background levels for all other elements and compounds considered. Rates of deposition on to vegetation and soil were modelled using deposition velocities obtained from the scientific literature. Accumulation was estimated by assuming maximum rates of deposition over a 20-year period, no loss by surface runoff or leaching and complete mixing in the top 5 cm of soil. It was assumed that the

combustion gases hydrogen chloride, bromide and fluoride and the oxides of nitrogen, phosphorus, sulphur and carbon would not accumulate in soil. On these assumptions, concentrations of most contaminants in soil attributable to emissions from the proposed expanded Centre would not exceed background or pre-existing values. Estimated concentrations of total dioxins and furans would exceed background-levels at the Centre, Chrystina Lake and at the Town of Swan Hills. Aluminum and cadmium would exceed background-levels at the Treatment Centre and Chrystina Lake. Chromium and PCBs would exceed background-levels at the Treatment Centre only. Chem-Security emphasized that these concentrations were based on extremely conservative assumptions appropriate for use in the assessment of health risks and that actual levels would almost certainly be much lower.

SHERC was concerned that the observed concentrations of pollutants in both air and soil were insufficient to account for the amounts of pollutants predicted to be emitted from the existing Centre. Dr. Hrudey, on behalf of the Town of Swan Hills, was able to establish that the discrepancy arose from the applicant's conservative assumptions that:

- emissions would run continuously at the maximum rate; and
- maximum rates would be the larger of the mean rates plus three standard deviations or the maximum observed rates.

SHERC also was concerned that the chemical composition of particulate emissions from the existing incinerator had not been analyzed so that it is impossible to estimate their potential contribution to the total amounts of the various chemical contaminants being deposited and moving through the ecosystem. Although SHERC was concerned in particular about fugitive dust, its concern is, perhaps, more warranted in relation to emissions of particulates during routine operation and during emergency venting because the concentrations of contaminants in these particulates are likely to be higher than those in resuspended dust.

Finally, SHERC drew attention to the applicant's use of the expression "less than background" to describe observed and estimated concentrations of contaminants. SHERC suggested that concentrations that are additional to background should be reflected in the health risk modelling because it is the combined concentration that determines the risk to which people and the environment will be exposed.

The Board agrees with Dr. Hrudey's explanation of the conservatism of the assumptions used in the risk assessment modelling and the fact that it accounts for the discrepancies between observed and estimated concentrations of contaminants. Given this conservatism, the Board accepts that the applicant's predictions of concentrations of contaminants in environmental components after 20 years of operation of the proposed expanded Centre are much higher than those that are most likely to occur. In addition, the Board believes that the applicant's monitoring program would detect a trend of increasing concentration of any contaminant soon enough to allow remedial action before risks to human health and the environment reached an unacceptable level. Because of the conservatism of the estimates, and because of the existence of the safeguard provided by the monitoring program, the Board believes that the estimates are

acceptable for the purpose of assessing potential effects of the proposed expansion. The Board has reviewed the short list of substances for which emissions from the proposed expanded Centre are predicted to exceed background levels in air, and that would lead to greater than background additions to contaminant concentrations in soil, and concluded that none of the predicted concentrations would constitute an unacceptable risk to human health or the environment.

With respect to the matter of methylation and demethylation rates in surface waters, discussed in section 7.5.1.4, the arguments about predicted future emissions explored above also apply. SHERC's concern was that increased emissions may lead to increased concentrations of contaminants in surface water and that this may affect methylation and demethylation rates of heavy metals such as mercury. The applicant's evidence showed that the existing operation had not had such an effect. The Board accepts the applicant's projections of future concentrations of contaminants and its conclusion that future effects on methylation and demethylation are unlikely. The Board therefore concludes that investigation and recording of methylation and demethylation rates in lakes near the Centre is not essential to protect the public or the environment.

With respect to uncertainty about quantities of contaminants contained in suspended particulates, the Board notes that particulates emitted from the Centre or resuspended as dust after being deposited on soil or vegetation are captured by high volume monitoring equipment and by passive long-term monitoring devices such as moss bags. In addition, the receptors such as water, soil and vegetation that were analyzed by the applicant also receive deposited particulates. Chem-Security did state that its predictions of future concentrations of contaminants in the environment include contributions from particulates, although no specific consideration of resuspended dust was included. The Board concluded in section 7.1.7.3 that resuspension of dust would tend to reduce higher contaminant concentrations near the source and slightly increase ones further away. The slight increases at some distance from the Centre would not be enough to significantly affect the conservatively high estimates of future concentrations of contaminants made by the applicant and would not invalidate the applicant's assessment of risks to human health and the environment.

The Board is satisfied that the applicant's estimates of concentration of contaminants that may be expected in environmental components are conservative (i.e., tend to overestimate what may actually occur). Moreover, the Board is aware that concentrations of contaminants arising from emissions, even if described as "less than background", are in fact additional to background when health and environmental risks are considered. The Board has taken this into account in considering the acceptability of risks to human health and the environment that may be engendered by the proposed expanded Centre.

7.5.3 Chlorinated Organic Compounds

7.5.3.1 Recognition of the Problem

The Board has chosen to discuss PCBs, chlorobenzenes and chlorophenols separately in this section because they are a subject of public concern and because the applicant has shown that the bulk of those released from the existing Centre originate from fugitive emissions from waste handling and storage facilities.

In 1989 and 1990, Chem-Security, in monitoring ambient air at the Centre, recorded 24-hour average concentrations of PCBs. Observed concentrations were less than 50 ng/m^3 until February 1990 when there was a sudden increase. During 1990, concentrations varied greatly and on about 8 percent of the days exceeded the maximum predicted by the applicant's dispersion model. PCBs were detected in red-backed vole tissues in June 1989 and subsequent sampling and analysis in September 1989, and February and June/July 1990 confirmed that concentrations in the voles were increasing, were correlated with the expected dispersion of emissions from the Centre and were of the same chemical type (Aroclor 1260). This led the applicant to expand the monitoring program, conduct a more detailed analysis of PCB levels in other environmental components, and examine the possible sources of larger than expected emissions of PCBs from the Centre.

The applicant's more detailed analyses of environmental components for PCBs detected PCBs in vegetation, the surface moss and "fibric" layer of the soil, species of terrestrial animals in addition to red-backed voles, and fish. PCBs were not detected in surface or groundwater but in 1990, the detection limit for PCBs in fish tissues was improved from 0.5 ng/g to 0.1 ng/g and the PCB formulation known as Aroclor 1254 was detected at concentrations below 0.5 ng/g. The concentrations are similar to those recorded in other non-industrial areas. Aroclor 1260 is the common formulation of PCB found in and near the Centre so the applicant concluded that the PCBs detected in fish did not originate from the Centre.

Analyses of terrestrial environmental components yielded a different result. No trace of chlorinated organics were detected by the routine soil monitoring program, but PCBs of the Aroclor 1260 type were detected in live moss growing at the soil surface in 1989 and 1990 when a more sensitive analytical method was used. At a few plots PCBs had reached the "fibric" layer beneath the live moss. It must be assumed that PCBs in the moss layer will be incorporated into the soil directly as the lower portions of the moss layer die and become humus or by leaching and binding on to organic molecules present in the soil. PCBs are likely to persist in soils, and particularly in organic soils, for a long time. There is insufficient knowledge of their behaviour in the soil types occurring in the vicinity of the Centre to predict how long.

PCBs were detected in trace amounts in foliage of black spruce and Labrador tea in 1989. The applicant undertook a supplementary monitoring program in 1990 in which analytical results from foliage and live moss samples were used to define the extent of the contaminated area.

The data show that an area of about 150 hectares has been affected, but suggest no significant trends in PCB concentrations through the September 1989, and February, June and September 1990 sampling periods. The September 1990 concentrations appear slightly lower than those observed earlier. The applicant suggests that the predominant pathway for uptake of PCBs by foliage is by direct deposition because PCBs do not move readily from soil into roots or from roots into foliage. Therefore, as measures are implemented to curtail PCB emissions, concentrations in foliage may decline before those in soil.

Chem-Security is continuing its enlarged program to monitor PCBs in animals living in the vicinity of the Centre. By 1990, red-backed voles within an area of 1000 ha showed whole body concentrations of PCBs greater than 0.05 parts per million (ppm) with the higher concentrations nearer to the Treatment Centre. The highest concentrations recorded in 1990 were 9.0 ppm in whole body tissues and 160 ppm in fat. Concentrations of PCBs in fat were consistently higher than in whole body tissues because of the tendency of PCBs to accumulate in fat. In February 1991, a concentration of 18.0 ppm in whole body tissues was recorded at the same site. Shrews, which are insectivorous and therefore at a higher trophic level than the predominately herbivorous voles, showed higher concentrations than voles taken at the same locations. In 1990, PCBs were also detected in specimens of meadow vole, red squirrel and ermine taken near the Centre. The applicant concluded that most resident animals near the Centre would have accumulated a low body burden of PCBs by then. Monitoring results for 1991 showed further increases in PCBs in whole body samples of voles, from most sampling stations. February and June monitoring periods in 1991 both preceded the implementation of remedial measures by the applicant.

7.5.3.2 Diagnosis of the Problem

The applicant calculated that observed concentrations of PCBs in the air and accumulations of PCBs in vegetation and in vole tissues were too high to be explained by stack and cooling tower emissions, even using extreme values. Furthermore, the Indian First Nations stated, and Chem-Security confirmed, that some tests of workers at the Centre had detected elevated levels of PCBs in blood. These are reviewed in section 7.6.2. As part of its response to the detection of a problem by its monitoring program, the applicant conducted a quantitative survey of fugitive emissions associated with waste handling. The estimated emission rates were then applied to air quality models and good agreement was obtained between predicted and observed data. The applicant concluded on this basis that fugitive emissions associated with waste handling were responsible for the elevated PCBs in the vicinity of the Treatment Centre. Accordingly, a program of remedial measures to reduce fugitive emissions was developed.

The quantitative assessment of fugitive emissions included chlorobenzenes and chlorophenols as well as PCBs. Both groups of chemicals are slightly less toxic than PCBs and in general less persistent in the environment, but chlorobenzenes were present in higher concentrations. Trichlorobenzenes were the most abundant constituent of the chlorobenzene fugitive emissions, exceeding air quality objectives by a factor of three. The EIA rated the

potential for impacts of trichlorobenzene emissions on wildlife as "low to moderate". Chlorophenols were also found in the fugitive emissions at relatively low levels.

7.5.3.3 Remedial Measures to Combat Fugitive Emissions

In addition to changes in the monitoring program, which are discussed in section 7.7.3.8, the applicant has indicated that changes are being undertaken with respect to the reduction of fugitive emissions. The changes vary from engineered changes to the heated storage building and the decant building to procedural and housekeeping changes for the organic tank farm. The operational control modifications will contribute to a reduction of contaminant concentrations inside the building and consequently will lower the emission rates from the building through the pollution control system. The engineered changes will ensure that those materials present in the air inside the building do not escape to contribute to increases in ambient concentrations in surrounding air.

Each of the pollution control systems to be installed for the heated storage building and the decant building will consist of an activated carbon filter preceded by a high efficiency particle absorption filter (10-15 percent of the PCB emissions have been shown to be attached to particles). Also, the inside building pressures will be maintained at a slight vacuum to prevent the escape of material when the doors are opened. Additionally, the drum decant and drum shredder stations in the decant building will be enclosed and duct work will vent these to the exhaust air system.

The proposed expansion would not contribute significantly to emissions at the above sites since the bulk of the increased waste supply would go directly to the waste feed receiving building, which has its own fugitive emission control system.

As a consequence of these actions, the level of emissions from these buildings is to be significantly reduced. Table 7-2 illustrates the level of improvement predicted to be achieved for one of the compounds, trichlorobenzene.

Table 7-2
Projected Reductions in the
Fugitive Emission Rates of Trichlorobenzene

Source	Existing Operations μg/s	Post Expansion μg/s
Decant Building	7,883	204
Heated Storage Building	3,055	204
Organic Tank Farm	2,051	813

Reference: EIA Table 4-9 -- Existing Operations

Reference: EIA Table 4-19 -- Post Expansion

Note: Tricholorobenzene Concentration = 0.73 x Chlorobenzene Concentration

The Board is satisfied with the current efforts to minimize fugitive emissions. It encourages the applicant to continue to review and upgrade procedures and systems so as to further lower emission levels and recommends that Alberta Environment assess the status of these procedures and systems on a yearly basis.

7.5.3.4 Expected Emissions and Ground-level Concentrations Following Remedial Measures

Chem-Security stated that the remedial measures outlined in the forgoing section will reduce fugitive emissions of all three classes of chlorinated organics by more than an order of magnitude. To place these reductions within the context of overall Centre emissions, the Board has compiled tables (Tables 7-3, 7-4 and 7-5) from data presented in the EIA. The four columns of numbers in each table show the average emission rates in micrograms per second (μg/s) from all emission sources (excluding emergency venting):

- before fugitive emission remedial measures (i.e., 1990);
- after remedial measures;
- post expansion, assuming the cooling tower has been retained; and
- post expansion, assuming removal of the cooling tower.

Stack emission estimates were based by the applicant on the average measured flue gas concentrations; fugitive emission estimates were based on building vent concentrations and flow rates.

Table 7-3

Estimated Emissions of PCBs (μg/s)

	EIA Document Reference	Pre-Expansion		Post-Expansion	
		1990	Remedial Measures	With Cooling Tower	Without Cooling Tower
Cooling Tower	Table A-7	26.2	26.2	26.2	0.0
Rocking Kiln	Table A-6	24.7	24.7	24.7	24.7
Rotary Kiln	Table A-8	53.0	53.0	53.0	53.0
Fugitive Emissions	Tables 4-9 & 4-19	483.5	41.8	41.8	41.8
New Kiln	Table A-9	0.0	0.0	139.5	139.5
Total (excluding emergency venting)		587.4	145.7	285.2	259.0

Table 7-4

Estimated Emissions of Chlorobenzenes (μg/s)

	EIA Document Reference	Pre-Expansion		Post-Expansion	
		1990	Remedial Measures	With Cooling Tower	Without Cooling Tower
Cooling Tower	Table A-7	25.8	25.8	25.8	0.0
Rocking Kiln	Table A-6	11.8	11.8	11.8	11.8
Rotary Kiln	Table A-8	10.9	10.9	10.9	10.9
Fugitive Emissions	Tables 4-9 & 4-19	19,230.0	1,666.0	1,666.0	1,666.0
New Kiln	Table A-9	0.0	0.0	1,550.0	1,550.0
Total (excluding emergency venting)		19,278.5	1,714.5	3,264.5	3,238.7

Table 7-5

Estimated Emissions of Chlorophenols (μg/s)

	EIA Document Reference	Pre-Expansion		Post-Expansion	
		1990	Remedial Measures	With Cooling Tower	Without Cooling Tower
Cooling Tower	Table A-7	1.60	1.60	1.60	0.00
Rocking Kiln	Table A-6	0.33	0.33	0.33	0.33
Rotary Kiln	Table A-8	0.53	0.53	0.53	0.53
Fugitive Emissions	Tables 4-9 & 4-19	4.88	0.45	0.45	0.45
New Kiln	Table A-9	0.00	0.00	32.55	32.55
Total (excluding emergency venting)		17.34	2.91	35.46	33.86

The Board's analysis is as follows:

PCBs

If the PCB numbers are considered at face value, the expected 12 fold reduction in fugitive emissions of PCBs would reduce overall pre-expansion emissions to roughly 1/4 of their 1990 level, but the proposed expansion would almost double that amount for a net reduction of roughly 1/2 from the quantities emitted by the existing Centre before remedial measures were taken. Ground-level concentrations in the vicinity of the Treatment Centre would be reduced to a greater extent than emission rates because fugitive emissions, which are released near ground level, should be greatly curtailed while stack emissions, though increased, would be released at a greater height than was previously the case and would therefore impinge over a larger area.

This assessment is based on the assumption used in the EIA that the average concentration of PCBs in the flue gas of the proposed incinerator would be comparable to that in the existing flue gas and that PCB feed rates would not decline in future. The applicant did not address possible changes in feedstock composition within the EIA and did not assess the effects of such changes on future emissions. However, the applicant stated at the hearing that the backlog of PCBs in Alberta was being depleted to the extent that it would soon be necessary to employ a surrogate chemical to assess the destruction and removal efficiency of the Treatment Centre incinerators. Unless PCB contaminated waste is imported from out-of-province, it is reasonable to expect declining feedrates of PCBs with a concomitant decrease in emissions. In this light, it is probable that the decline in total emissions will be greater than the 50 percent

decline indicated in Table 7-3. However, without the benefit of a forecast of the rate of decline of PCBs in the incinerator feedstock it is not possible to determine how much lower PCB emissions might be.

The rates at which PCBs either accumulate in or disappear from soil and vegetation reflect a balance between the rates of deposition and removal. It is therefore possible that a small decline in emissions from the Centre would produce a decline in deposition but no decline or even a marginal increase in PCB concentrations in soil and vegetation if the rate of deposition were to exceed the rate of removal. Comparison of the predicted annual average ground-level concentration maps provided in the EIA shows that, in the present instance, ground-level concentrations of PCBs, and therefore deposition rates, would be expected to decline by an order of magnitude after expansion.

Chem-Security suggests that most of the PCBs in foliage come from direct deposition on plants rather than through uptake into roots and subsequent translocation. One of the reasons is the binding of PCBs to organic compounds in the soil and in the roots. It follows that reduction in direct deposition should have an immediate effect on PCB concentrations in foliage and, in turn, in animals at higher trophic levels. On the other hand, bioaccumulation and biomagnification from PCBs already present and the lower annual quantities deposited would still occur. Because little is known about the rates of leaching or breakdown of PCBs in soils and vegetation present in the Swan Hills region, it is not possible to arrive at reliable estimates of when and at what levels PCB concentrations in biota would peak. It is certain that reduction of PCB emissions and wider dispersion of emitted substances from a taller stack would both reduce peak concentrations. On the other hand, bioaccumulation and biomagnification over a longer time period may offset to an unpredictable extent the lowering of concentrations of PCBs in animal tissues expected to result from the wider physical dispersion of pollutants afforded by the elevated stack height. As discussed in section 7.6, the applicant has estimated potential PCB concentrations and accumulation in herbivores and people using very conservative assumptions. Its conclusions are that the estimated concentrations would not engender unacceptable risks to human or animal health. No evidence was presented that would lead the Board to reject this conclusion.

Chlorobenzenes

Fugitive emissions of chlorobenzenes accounted for greater than 99 percent of chlorobenzene emissions in 1990. The proposed remedial measures are expected to reduce the overall emissions to less than a tenth of their former value, but the addition of the proposed incinerator would roughly double that rate resulting in an overall six-fold decline in chlorobenzene emissions. In contrast to PCBs, there is no reason to expect that the feedrate of chlorobenzenes would decline. The acute toxicity, environmental persistence and bioaccumulation potential of chlorobenzenes increase with their degree of chlorination, so the relative quantities of congeners bearing different numbers of chlorine atoms are of some concern. Trichlorobenzenes and tetrachlorobenzenes accounted for 73 percent and 19 percent respectively of fugitive emissions and are expected to account for 87 percent and 10 percent

respectively of stack emissions from the proposed incinerator. Thus, the overall decline in trichlorobenzene and tetrachlorobenzene emissions, ignoring the marginal contributions from the existing stacks, would be roughly 5-fold and 8-fold respectively. The corresponding decline in ground-level trichlorobenzene concentration would be roughly 10-fold, effectively lowering the ambient level of this pollutant below the air quality objective previously exceeded.

Chlorophenols

Chlorophenol emissions have been and will continue to be small in relation to PCBs and particularly in relation to chlorobenzenes. Remedial measures are expected to reduce overall emissions by a little more than half, but the proposed incinerator would release more than any of the previous sources. The net result would be a five-fold increase in chlorophenol emissions over the quantities emitted by the existing Centre before measures were taken to reduce fugitive emissions. Despite the increase, the projected levels would be an order of magnitude less than expected PCB emissions. The relatively low emission rates and lower toxicity of chlorophenols compared to PCBs make chlorophenol emissions a minor issue, assuming that the composition of feedstock remains within the present range. If large volumes of waste contaminated by pentachlorophenols (PCPs) are to be treated the matter will require re-examination as required in section 7.1.5.2.

7.5.3.5 Conclusions Respecting Chlorinated Organic Compounds

The Board accepts the applicant's predictions of the potential benefits of the remedial measures to curtail fugitive emissions on the understanding that improvements in fugitive emission controls will be demonstrated through ongoing monitoring. With respect to PCB emissions, the Board believes that the assumption that PCB feedrates will remain constant is appropriate to the purpose of ensuring a conservative assessment of health risk. However, the Board recognizes that the assumption leads to an estimate of future PCB emissions that is likely to lie at the upper boundary of possible values rather than an estimate with a high probability of proving accurate. As discussed earlier, actual PCB feed rates are likely to be lower unless PCB contaminated waste is imported from out of province. If PCB feed rates remain near past levels or increase, re-examination of potential concentrations in environmental components and of risks to human and animal health may be necessary. The Board therefore requires that Chem-Security monitor PCB content in the feedstock to the Centre, and, if feedstock containing PCBs returns to volumes or concentrations similar to those encountered in previous years, Chem-Security reassess possible emissions and the consequent risks to human health and the environment, discuss the results with Alberta Environment and make any changes to equipment and treatment processes that Alberta Environment may require.

The Board is satisfied that emissions of trichlorobenzenes will be significantly reduced to below the ambient air quality objective. At this level the health risk would be acceptable. The Board also concludes that chlorophenol emissions would be acceptably low provided there are no significant changes in the composition of the waste feedstock.

7.6 Risks to Human Health and the Environment

It is convenient to consider public health, occupational health and environmental risks separately in this report, although the applicant used the same general method and the same observed and predicted concentrations of contaminants to assess all three. Questions about the general method of assessment are dealt with in the first subsection which is about public health.

7.6.1 Public Health

7.6.1.1 Health Risk Methodology

The applicant assessed the risks to public health posed by acute and chronic exposure to emissions from the existing and proposed expanded Treatment Centre by estimating an index called the Relative Margin of Safety (RMOS) for each of the 67 priority contaminants and for groups of contaminants known to have similar effects on human health. The RMOS is calculated as a ratio of *a:b* where *a* is the anticipated exposure and *b* is the exposure deemed acceptable on the basis of published epidemiological and toxicological studies.

Short-term RMOS values, estimating the health risks associated with acute exposures, were calculated from the maximum one hour average exposures to the predicted ground-level pollutant concentrations. Inhalation was the only exposure route assessed. Short-term RMOS values were estimated for six hypothetical individuals with differing probable exposures: an operator and an office worker at the Treatment Centre, a child and an adult at Chrystina Lake, and a child and an adult in the Town of Swan Hills.

Long-term RMOS values, estimating the health risks associated with chronic exposures, were calculated on the assumption that exposure would occur through inhalation, ingestion and dermal absorption for a full 70-year human lifetime. The Centre was assumed to operate for the first 20 years of that lifetime and soil levels were assumed to contain, from the outset, concentrations of contaminants they would reach after 20 years of deposition. The ground-level concentrations of contaminants used in these calculations were derived from dispersion modelling. Deposition velocities, partition coefficients and information on uptake and depuration rates from the literature were used to model contaminant pathways and estimate long-term exposures. Long-term RMOS values were estimated for four hypothetical individuals having differing probable exposures: an operator and an office worker at the Treatment Centre and a child and adult in the Town of Swan Hills.

Exposure limits deemed to represent an acceptable risk (the denominators) were of two sorts depending on the contaminant's dose-response curve. For chemicals with a threshold of effect, the denominator was a reference dose below which no adverse effect would be expected.

For chemicals without a threshold of effect, the denominator was a risk specific dose corresponding to 1 incidence in 100,000 exposures.

Some interveners suggested that the explanation of the RMOS Health Risk Methodology in the EIA was not readily understandable. In particular:

- a higher 'margin of safety' might reasonably be expected to imply a lower risk but in fact the reverse is the case; and

- it was not clear how the method was applied to contaminants that pose long-term health risks such as those that can initiate cancer.

Additional evidence presented by Chem-Security at the hearing clarified these issues: the RMOS ratio parallels the US EPA's unit risk assessment number in that it increases with risk. The applicant believes that such a positive correlation is more, rather than less, intelligible to laymen.

Chem-Security also provided an explanation of how it used the RMOS method to deal with substances posing long-term (chronic) health risks. Chemical carcinogens that induce self-propagating lesions belong to the group of chemicals that do not display a threshold of effect. It is not possible, therefore, to define a dose below which there is no induction of cancer; it is only possible to choose a risk specific dose at a level of risk that is deemed acceptable. Because the risk of cancer increases with the duration of exposure, the most conservative assumption with respect to the duration is that exposure is for a 70-year lifetime. Accordingly, the risk specific dose used for non-threshold chemicals was the level that would result in a risk of 1 in 100,000 during a lifetime of exposure. This level of risk corresponds to an RMOS of unity (1.0). US EPA experience and operating policy is that risks below 1 in 100,000 are considered acceptable by the public; those of 1 in 10,000, which corresponds to an RMOS of 10, or above are generally considered unacceptable.

The Board notes that the practice in US EPA risk assessment is to start out with assumptions that are extremely conservative. Risks that are less than 1 in 1,000,000 are screened out, that is, they can be accepted as safe. When an initial risk estimate is greater than 1 in 1,000,000, the assumptions on which that estimate are based are re-examined. Because of the conservatism of the initial assumptions, the US EPA finds many initial risk estimates in the 1 in 100,000 to 1 in 1,000,000 range acceptable on re-examination. The applicant believes that the assumptions it made in estimating health risks were conservative in all cases, so that actual exposures, and hence risks, would be lower than those estimated. Nevertheless, in completing the risk analysis, the applicant conducted a detailed re-evaluation of the assumptions made in estimating exposures for all contaminants where RMOS values greater than 0.1 were obtained.

Two further matters related to the methodology employed in the health risk assessment were raised at the hearing:

- the extent to which exposure limits reflect the hazards posed to exceptionally sensitive individuals, and;

- the practice of assuming additivity of RMOS values as a means to assess the combined effects of groups of pollutants.

The evidence presented by Chem-Security indicated that for some contaminants such as sulphur and nitrogen oxides, which can act as respiratory irritants, exposure levels were based on hospital admission rates during and following episodes of relatively high exposure. Thus, sensitive groups such as smokers and asthmatics would inevitably be included in the statistics. In other cases specific action was taken to account for individual differences in sensitivity. Thus, the exposure limit of children to lead is lower than the adult level because children are known to be more susceptible to lead poisoning. This is the reason that adults and children were treated separately in the health risk assessment.

Chem-Security added the RMOS values of the members of some groups of chemicals with similar effects on human health to assess their combined risk. Similar groups of chemicals may act on certain organs such as the liver or lungs in a similar manner. Their combined effects could be additive or synergistic (i.e., multiplicative). For example, combustion gases primarily affect the lungs and so were treated as a group. In contrast, members of some groups of chemicals such as metals tend to affect different organ systems and were therefore assumed not to have additive or synergistic effects. The RMOS values of chemicals belonging to a group were added rather than multiplied because the addition of fractions yields larger numbers than multiplication and was considered by the applicant to be conservative. In the Board's view attention should be focused on actual risk rather than RMOS values. Addition of risk is not conservative compared to the multiplication that would be appropriate if synergy were to occur. However, the Board recognizes that synergistic effects normally cannot be detected until exposures are much higher. The applicant stated that if RMOS values had been higher, it would have examined the potential for synergistic effects in greater detail.

Ambiguities in the presentation of the health risk methodology were substantially overcome during questioning at the hearing. The Board is therefore prepared to accept that the health risk analysis was conducted in an appropriately conservative fashion and that its results can be accepted with confidence.

7.6.1.2 RMOS Values Greater than Unity

All short-term RMOS values were acceptably low, indicating that no adverse health effects are anticipated due to acute exposure to emissions from the Treatment Centre. The EIA presents estimates of the long-term RMOS values for the four hypothetical individuals referred to in section 7.6.1.1 subject to the three exposure scenarios:

contaminants due to:

- background-levels;
- the existing Treatment Centre; and
- the expanded Centre.

Among the estimates, most values were very low, indicating that the risks are presently and are expected to remain very slight indeed, particularly given the conservative assumptions that were made to obtain the estimates. The exceptions, in which RMOS values were greater than 1.0 were for the metals arsenic and beryllium, the volatile organics benzene and carbon tetrachloride, the combustion gases as a group, and chlorobenzenes. In every case but chlorobenzenes, the high RMOS values were associated with exposure to the assumed or measured background concentrations of pollutants; the effect of the Treatment Centre was assessed as negligible.

The Board has made the following analysis of those situations where the RMOS values were greater than 1.0.

Arsenic

Both arsenic and the other metal on the list, beryllium, are associated with an elevated risk of lung cancer. Arsenic is also associated with skin cancer and it was the skin cancer data that were used in assessing the risk specific dose for this metal. Although it is not clear that this represents a conservative assumption in light of the lung cancer data, it is clear that the RMOS value exceeds 1.0 because the background exposure is assumed to be high. Exposure attributable to Treatment Centre emissions is currently ten thousand-fold less than the assumed background exposure and this would not be expected to change substantially should the proposed expansion be built. The risk to human health posed by long-term exposure to arsenic emitted by the Treatment Centre is currently very low and would be very low after expansion.

Beryllium

Both epidemiological studies and experimental studies provide evidence that exposure to beryllium is associated with an increased risk of lung cancer. The RMOS values greater than 1.0 for background-levels are attributable to the choice of conservative exposure limits used to assess the risks associated with ingestion and inhalation. Emissions from the Treatment Centre currently contribute roughly one-thousandth of the background exposure. The proposed expansion of the Treatment Centre would not significantly alter exposure to this element. The risk to human health has been and would continue to be very low.

Benzene

Benzene is also a carcinogen, causing leukemia and other cancers. The available data from epidemiological and experimental studies make it difficult to characterize the dose-response curve. The applicant chose what it regards as the more conservative model to obtain its estimated risk specific dose. The background RMOS greater than 1.0 suggests that the choice

was too conservative; it is unlikely that background-levels of benzene in northern Alberta are a health risk. Emissions of benzene from the Treatment Center are now and would be responsible for about one-millionth of the background-level of exposure, posing a negligible long-term risk to human health.

Carbon Tetrachloride

Carbon tetrachloride is associated with several forms of cancer and damage to both the liver and kidneys. Difficulties in assessing an appropriate risk specific dose are probably responsible for the initial estimates of background RMOS's greater than 1.0. Exposure to the Treatment Centre emissions presently accounts for only one ten-thousandth of the background exposure. Construction of the proposed incinerator would not substantially increase the proportion of exposure due to the Treatment Centre. The long-term risk to human health would be very low.

Combustion Gases

Among the four hypothetical target individuals only the town child had an estimated background RMOS exceeding 1.0. Since the combustion gases are respiratory irritants any effect of ambient levels should already be apparent if there is a problem. Emissions of combustion gases from the Treatment Centre currently account for about one-thousandth of the assumed background exposure, posing a minimal long-term health risk. No substantial change is anticipated.

Chlorobenzenes

Unlike the other contaminants listed above, the chlorobenzenes present a more significant problem. Chlorobenzenes are carcinogenic. The high RMOS values estimated for Treatment Centre office workers (1.11) and operators (1.48) at the existing facility compare to a background RMOS in the order of 0.001. This means that emissions from the Treatment Centre may have resulted in elevated health risks to plant workers. The comparable risks for children and adults in the Town of Swan Hills were low because fugitive emissions from plant buildings caused the high ground-level concentrations at the Centre. In contrast, the ground-level concentrations at the Town of Swan Hills were five orders of magnitude lower and risks to children and adults in the town from exposure to chlorobenzenes were very low. Remedial measures to reduce fugitive emissions are expected to reduce exposure of Centre personnel to chlorobenzenes from Treatment Centre sources to below the background exposure levels and consequently to reduce long-term health risks to an acceptable level.

The Board is satisfied that none of the chemical contaminants reviewed by the applicant would give rise to an unacceptable risk to the health of Centre staff or residents of nearby towns if the expanded Centre were to operate as planned. The evidence before the Board suggests that

fugitive emissions of chlorobenzenes from the existing Treatment Centre may have resulted in some risk to plant workers. However, the Board is confident that the measures Chem-Security is taking to control fugitive emissions will control this risk to an acceptable level.

7.6.1.3 Drinking Water

At the hearing, the applicant stated that the Coutts River, Saulteaux River, Ethel Creek and Chrystina Lake are not used as sources for drinking water. In addition, the Board concluded in section 7.5.1.1 that monitoring of water from these sources indicates no decline in quality attributable to the operation of the Treatment Centre to date.

The Board concludes that the current emissions from the Centre and predicted future emissions from the proposed expanded Centre should not increase contamination of the water bodies listed above to levels that would give rise to unacceptable risks if they were used as sources of drinking water. The Board is also satisfied that the current monitoring program will detect any change in water quality soon after as it occurs. The Board recommends that the analytical data and the sampling protocols used to obtain them be reviewed by Alberta Environment on a yearly basis.

7.6.1.4 Public Health Monitoring

The applicant has no plans to monitor the health of local residents other than those working at the Centre, although it has had discussions with the Sturgeon Health Unit about the subject. In the applicant's opinion, the monitoring of concentrations of contaminants in environmental receptors in the area and the monitoring of the health of workers at the Centre are likely to detect potential problems before public health monitoring would show significant results.

In their written submission, the Indian First Nations asked that the Board make approval of the project conditional on a number of items including a requirement that Chem-Security undertake:

> "...a survey of contaminant levels in the hair, blood and breast milk of residents of (the communities around Lesser Slave Lake) ... to assess whether or not the present exposure to contaminants poses a measurable risk to the residents of these communities".

This request is one of a series which make up a proposed regional biological-effects monitoring program. The proposed program is discussed in section 7.7.2 of this report.

In section 7.7.2, the Board concludes that extension of the applicant's existing monitoring program to include the area occupied by the communities around Lesser Slave Lake would not be necessary to detect the presence in the ecosystem of contaminants originating from the Treatment Centre and that any results of measuring contaminant concentrations in people resident in the communities could not be related to emissions from the Centre. It could be argued that

Indian people hunting and trapping in the vicinity of the Centre might be exposed to higher levels of contamination by eating animals caught or shot there. People would occupy the role of top carnivore in the food chain. However, the applicant's evidence shows that to be exposed to any significant health risk, an individual carnivore, regardless of species, would have had to subsist entirely on animals captured within the area of highest contamination by PCBs during the period when PCB contaminated wastes were being incinerated and fugitive emissions had not been subject to more stringent controls. Animal production in the small area of highest contamination may not be sufficient to support a human being, even one willing to accept a diet consisting almost entirely of voles and other small mammals. The Board's conclusion is that residents of the communities along the south shore of Lesser Slave Lake, even when dependent on country foods, are not likely to be exposed through this pathway to measurable doses of contaminants originating from the Treatment Centre. Therefore, the Board does not believe that an argument can be sustained that Chem-Security should mount a program to monitor contaminant concentrations in residents of these particular communities.

In addition, the Board accepts the applicant's reasoning that monitoring of environmental receptors in the vicinity of the Treatment Centre and of workers employed there would detect problems of contamination before public health monitoring could do so. The Board notes that, if public health monitoring were to be used, an exhaustive sampling design and a very detailed assessment would be required. Even if public cooperation could be secured, such a program would be very expensive and the results difficult to interpret. However, the Board is aware that the Sturgeon Health Unit does maintain public health statistics for the area. Such epidemiological data could detect trends in affliction that might be attributable to cumulative emissions to which the Treatment Centre would contribute. A conservative approach to the management of health risk would call for examination of such data, even if the probability that they would provide evidence of effects on health is low. The Board therefore recommends that Chem-Security meet with the Sturgeon Health Unit to review its epidemiological data annually, or less frequently should the Health Unit consider that adequate.

7.6.2 Occupational Health and Safety

Workers at the Centre, most of whom are, or will be, resident in the Town of Swan Hills, are likely to be the people exposed to the highest doses of any contaminants released by waste stored or treated at the Centre. Attention to reducing their exposure and monitoring their health is therefore a priority for the applicant. The applicant has instituted procedures to ensure that workers are not inadvertently prolonging their potential exposure by carrying contaminants with them when they leave the Centre. Workers leave the clothes worn at the Centre on the site at the end of their work day or shift and take a shower on-site before leaving. Chem-Security employs a full-time occupational hygienist at the Treatment Centre. It also monitors indoor air quality and stated that its monitoring results showed that it had never failed to meet standards set by Alberta Occupational Health and Safety. As a result of the concern over fugitive emissions, the applicant has taken additional steps to keep indoor air clean by the use of charcoal filtering. Worker health protection is an important factor in plant and process design. For example, the applicant proposes to use a wet slag conveyor system with the new incinerator

because this reduces emission of particulates from the moving material. Chem-Security stated that it worked closely with Alberta Occupational Health and Safety to ensure that the existing Treatment Centre and proposed expansion were both designed in accordance with provincial guidelines for construction and operation of new plants. It also subjects all its personnel to a formal safety training program.

The applicant said that employees undergo annual or semi-annual examinations, depending on their work station, at which general health parameters including blood pressure are checked. PCB blood levels are also tested; results of the occupational health monitoring are reported to the regulatory agencies and, in particular, PCB levels in blood are reported to Alberta Occupational Health and Safety.

Chem-Security said that studies reported in the literature show that concentrations of PCBs in blood of the general population, i.e., people who are not occupationally exposed to PCBs, vary from undetectable levels to about 30 parts per billion (ppb). Chem-Security has defined 3 action levels for dealing with the results of monitoring the blood of its staff. Where concentrations of PCBs in blood are less than 5 ppb no action is taken. If they are between 5 and 30 ppb, Chem-Security's occupational hygienist conducts an investigation to determine potential sources of contamination and repeat testing is done in 3 months. If levels are between 30 and 100 ppb, the worker is relocated to a work station where he or she is less likely to be exposed and repeat testing is done every 3 months until the concentration declines below 30 ppb. Finally, if levels are above 100 ppb, the worker is removed from the Treatment Centre.

Chem-Security reported that in February 1991 one hundred and three workers were analyzed and of these, 3 showed blood concentrations of PCBs between 30 and 100 ppb. Fifty-four ppb was the highest reading obtained. All three were treated as described above and their blood PCB concentrations have subsequently decreased. Of the remaining 100 workers, 75 showed concentrations less than 5 ppb at the time of sampling. Chem-Security stated that there is no evidence that a blood concentration of 100 ppb of PCBs is cause for concern on medical grounds and that its monitoring program is intended to verify the effectiveness of its occupational health and safety programs. Action to relocate staff showing levels of more than 30 ppb of PCBs was taken as part of a policy to minimize exposure of workers.

The applicant stated that results of health monitoring programs are: "openly shared with the Treatment Centre Safety Committee, the Swan Hills Special Waste Liaison Committee, the Town of Swan Hills and provincial government departments" and that the applicant has: "... made a commitment ... to cooperate with the Sturgeon Health Unit and Alberta Health in addressing any outstanding public health issues in the region related to the operation of the Centre". Public participation in the monitoring program is discussed in section 7.7.4 of this report.

The Board has reviewed all the written and oral evidence provided by the applicant with respect to occupational health and is satisfied that the programs that the applicant has in place to reduce worker exposure to contaminants in the workplace and to monitor the health of

workers are appropriate for current and anticipated operations. If the nature of wastes processed at the Centre were to change it would be necessary to review and perhaps change these programs. For example, if waste containing high concentrations of heavy metals were processed, it would be advisable to include analysis for these in the blood monitoring programs. The Board therefore recommends that, if there are significant changes in the composition of the waste stream treated at the Centre, the applicant reviews the potential effects of those changes with Alberta Occupational Health and Safety and make any revisions that may be required to its programs to protect the health of workers at the Treatment Centre.

7.6.3 Environmental Risk

The EIA provided information about the observed and predicted concentrations of contaminants in many ecosystem components including air, surface and groundwater, soil, vegetation, several animal species and man. Detailed analysis of risk, however, was primarily concerned with human health. The applicant explained that exposure limits for protection of human health are often obtained by adding an additional margin of safety of ten or one-hundredfold to limits obtained by direct observation of animals exposed to contaminants. It follows that what is safe for humans is safe for animals. There are exceptions to this generalization because the sensitivity of species to particular contaminants differs. Nevertheless, the applicant generally followed the normal practice in risk assessment and made the assumption that what is safe for people is safe for animals and, by extension, plants. The applicant believes that the assumption was a safe one because estimated exposures and risk probabilities were very low for almost all contaminants and, for the few that were not, more detailed assessment had been done.

The Board finds this approach reasonable provided actual exposures to which animals or other ecosystem components are subjected are within the same order of magnitude as those experienced by people. However, as the applicant noted, animals which have small home ranges and live in the areas of highest exposure could be subjected to higher exposures, both directly and through bioaccumulation, than people resident in the Town of Swan Hills or working at the Treatment Centre. The red-backed voles which enabled the applicant to detect the problem with fugitive emissions of PCBs very quickly are a terrestrial example of species subject to high exposures. In 1991, concentrations of PCBs in red-backed voles were still very low and did not constitute a risk to the survival of the population. Nevertheless, the applicant did develop a predictive pathways model to determine potential uptake and retention of PCBs by wildlife. It concluded that the ingestion of contaminated vegetation in the vicinity of the Centre by herbivorous game species would not be hazardous to their health.

An important question, in the opinion of the Board, is whether red-backed voles are the species likely to be subjected to the highest exposure. In terms of acute risks arising from the inhalation of air containing contaminants which are currently, or may in future be, emitted from the Treatment Centre, this may be the case because individual voles have small home ranges and some may reside near the Centre. The applicant provided evidence that ambient concentrations of the common combustion gases which are the most abundant pollutants in the emissions would

not be high enough to have acute toxic effects on voles or other animals. Of the other 67 contaminants examined, only chlorobenzenes were predicted to exceed air quality objectives. The applicant considered that predicted chlorobenzene concentrations could have a "low to moderate" impact on resident animals and that predicted concentrations of other contaminants would have negligible effects. However, the applicant qualified this opinion because the source of much of the chlorobenzene is fugitive emissions and these are expected to be greatly reduced by remedial measures that the applicant intends to implement. After remediation, the potential for impact on animals would be negligible.

The situation is somewhat different where chronic risks are concerned. Because of their position in the terrestrial food chain voles are likely to be more exposed to chronic risks than vegetation but perhaps less exposed than small carnivores. Large carnivores would have larger home ranges and would take prey from an area of lower mean contaminant concentration. Top carnivores, such as birds of prey with small home ranges very close to the Centre, might be most exposed. The applicant did not prepare a predictive pathways model for carnivorous mammals and birds, but it did suggest that sensitive carnivores might be adversely affected if fed on a long-term diet of voles carrying the highest body burdens of PCBs detected by the monitoring program. The applicant believes that this would not occur because the reduction of fugitive emissions of PCBs would, in the long run, lead to lower body burdens of PCBs and because carnivores resident near the plant are small in numbers and have relatively large home ranges. Their diet could not consist entirely of the most heavily contaminated prey.

SHERC and the Indian First Nations asked the applicant whether it could incorporate carnivorous species into the monitoring program. The applicant is monitoring brook trout, the top carnivore in Chrystina Lake. The applicant also reported that it had discovered a population of white suckers in the same lake. It also intends to monitor that species. Unfortunately, the numbers of terrestrial carnivores present in the area are too small to allow the taking of sufficient animals to provide a data set from which conclusions could be drawn. Sampling could severely impact the local populations. More than one intervener suggested that the applicant collect tissue samples from animals trapped in the area around the Centre. While this may provide some scattered data of interest to the applicant, trapper return statistics provided in the EIA suggest, and the Board agrees, that the numbers of carnivorous animals trapped would be insufficient to provide a monitoring program design adequate to attribute changes in levels of contamination to possible causes.

While the Board has concerns about the exposure of carnivores to PCBs, it accepts that the applicant's measures to reduce fugitive emissions and its projected lower throughput of PCBs in waste should prevent body burdens of PCBs in prey species such as voles rising to levels that would cause unacceptable risks to carnivores. Furthermore, the Board believes that the program of monitoring abundant predominantly herbivorous terrestrial species such as the red-backed vole and the existing and proposed monitoring of aquatic species such as brook trout and white suckers, will detect contamination by PCBs and other toxic substances before they reach concentrations that would engender unacceptable risks.

The applicant presented evidence and argument about the risk to animals and plants of predicted concentrations of all of the 67 contaminants selected for detailed analysis. It concluded that there is a potential for trichlorobenzene to accumulate in the same animal populations as PCBs. The principal source of chlorobenzenes has been from fugitive emissions from waste handling facilities at the Centre and the applicant suggested that its plans to reduce these emissions would reduce exposures of organisms to chlorobenzenes, including trichlorobenzene, to levels that would have negligible impact. The applicant also reviewed the potential for accumulations in organisms of dioxins and furans predicted to be emitted from the Centre and concluded that the potential for adverse impact is low, long-term and local. Chem-Security found the potential for adverse impact of the rest of the 67 contaminants it studied in detail to be negligible. The Board neither saw nor heard evidence to doubt Chem-Security's conclusions with respect to risks to animals and plants and finds the risks as defined by Chem-Security to be acceptable.

Other environmental risks considered by the Board concern soil and water quality. None of the observational data or predicted concentrations of contaminants in water, soil or vegetation suggest that unacceptable risks will be encountered. The question of drinking water quality has been addressed in sections 7.5.1.1 and 7.6.1.3 and the risk to groundwater quality from the applicant's injection well is discussed in section 9. There is little agricultural use near the Centre so agricultural soils are unlikely to show detectable increases in contaminant concentrations that are attributable to emissions from the expanded plant. No evidence was presented to the Board to suggest that unacceptable risks might occur as a result of contamination of these ecosystem components. The Board has, however, reviewed all of the information before it, and has concluded that the predicted low levels of risk to soils and water quality are acceptable. Should the Centre not operate as planned, the Board is satisfied that the applicant's monitoring program would detect unanticipated contamination in time to allow remedial measures to be taken.

In conclusion, the Board has comprehensively reviewed the evidence with respect to risks that might arise as a result of contamination of the various components of the environment. The Board agrees with the applicant's reasoning that predicted contaminant levels would generate risks that are acceptable. The Board takes additional comfort from its conclusion that the applicant's existing and proposed monitoring programs will detect any increases in contaminant concentrations that may occur before they reach levels at which risks become unacceptable. The Board recommends that, if Chem-Security detects a statistically significant increase in the concentration of any contaminant in any environmental component over a period of 3 or more years the matter be brought to the attention of Alberta Environment and any need for remedial action be discussed as part of the annual licence review.

7.7 Monitoring

7.7.1 Philosophy and Objectives of Monitoring

The applicant's monitoring objective is to detect, directly or indirectly, emissions from the Centre that may give rise to unacceptable risks to human health and the environment. In general, the applicant monitors contaminants which could give rise to short-term (acute) risks, such as combustion gases and hydrogen chloride, in flue gas and in ambient air. Contaminants which could give rise to long-term (chronic) risks through deposition and accumulation in environmental components, including people, are monitored by analysis of samples of the receptors. The applicant does conduct, and proposes to continue, monitoring of ambient air for a few of the latter class of contaminants such as PCBs. Because such contaminants are usually present in very low concentrations, high volume or long-term accumulation samples must be used.

SHERC expressed the opinion that, in the monitoring of contaminants in flue gases and ambient air, and in the modelling of concentrations of contaminants in ambient air and the deposition of contaminants from air, too much attention is paid to combustion gases which pose acute risks and not enough to contaminants that could give rise to chronic risks. SHERC made reference to the 13 chemicals from the Ontario level of concern 1 list that may be present in emissions from the proposed expanded Centre. SHERC also acknowledged that the monitoring program was working well as an early warning system, quoting the example of the fugitive emissions of PCBs, but suggested that it did not go far enough in determining the ultimate fate in the environment of the priority pollutants. SHERC and the Indian First Nations recommended additional monitoring of wet and dry deposition of these pollutants in the areas identified by the emission modelling as those where ground-level concentrations of contaminants in air are likely to be highest. They also recommended monthly as opposed to quarterly or annual analysis of accumulated deposition samples. They argued that such monitoring could also deal more exhaustively with the determination of the composition of particulates which would be collected by the deposition samplers and could be analyzed for any contaminant of interest.

The applicant indicated that its primary concern is avoiding or reducing risks to people and the environment. It believes that the monitoring of receptors is providing sufficiently early warning of problems by demonstrating increasing concentrations of contaminants, if and when they occur and soon after they begin. As set out in section 7.5, the applicant saw no evidence that significant quantities of contaminants were unaccounted for by the monitoring program. If, in fact, this is the case, further monitoring of low concentration contaminants in air will add little to the capability of the monitoring program to fulfill its objectives. Nevertheless, the applicant has instituted high-volume air sampling for some low concentration contaminants, including PCBs, where it has reason to believe that additional attention is desirable.

It is the responsibility of the Board to determine what is in the public interest. The most important component of the public interest is the health and safety of people resident in the vicinity of the Treatment Centre. The Board considers that this particular component is best

served by the applicant's objective of ensuring that the Centre meets emission limits defined by Alberta Environment during its licensing process. The Board is also satisfied that the applicant's priority in designing the monitoring programs primarily to detect potential risks as soon as possible is both wise and responsible. The Board does not believe that it would be in the interest of the people of Alberta for it to encourage Chem-Security to use a full scale operating incinerator to experiment with new methods of controlling emissions or to design a monitoring program with the primary objective of determining the ultimate fate of all substances emitted from the Centre. This does not mean that the Board is opposed to technological innovation, but it believes that experimental methods of pollution control should first be tried on pilot scale incinerators. Similarly, the Board accepts that the further study of the fate of emissions is desirable, but not as a first priority.

The Board acknowledges that the monitoring of ambient air quality does not include sampling of most of the 13 contaminants identified as level of concern 1 by the Ontario Government and which are likely to be emitted from the proposed expanded Centre. The exception is PCBs. As discussed in sections 7.5 and 7.6, these contaminants are present in very low concentrations in air and may be present at concentrations below detection limits. Nevertheless, low concentrations, if sustained, may give rise to risks to human health and the environment because of long-term accumulation in environmental components. Experience with PCBs has shown that the monitoring of environmental receptors is adequate to provide early warning of increasing accumulations of these. As the available waste stream moves from PCB contaminated material to other types of waste, it is important that the contaminants that may be present in those other waste types be recognized in the monitoring program design. In the opinion of the Board, the monitoring program is adequate to protect human health and the environment, provided the Board's recommendations in sections 7.1, 7.5 and 7.8 that deal with changes in the composition of the waste stream and the annual review of the monitoring program by Alberta Environment are acted upon.

7.7.2 Regional Biological Effects Monitoring

Chem-Security's monitoring program is designed to detect contamination of the environment and people that can be traced to emissions from the Treatment Centre. With the exception of a few control stations, monitoring is confined to the geographical area within which Chem-Security expects that contaminants might be present in the future at detectable concentrations if planned operations continue normally or in which contaminants might first be detected if there is a departure from normal planned operation. As discussed in section 7.7.1, the Board finds this approach to monitoring by the applicant appropriate and responsible.

The Indian First Nations acknowledged that the existing monitoring program is adequate to provide early warning of contamination but requested the Board to require the applicant to mount a "Regional Biological-Effects Monitoring Program" that would be broader in scope. "Region" in this context was defined as a large area around the Centre and extending at least to Lesser Slave Lake. The principal elements of the proposed program would be:

- expansion of the existing program to cover a larger area including the Indian Reserves and traditional use areas around Lesser Slave Lake;

- expansion of the existing program to include other species and populations, especially carnivores;

- active participation of trappers in gathering samples and the opportunistic use of road kills; and

- a survey of contaminant concentrations in the hair, blood and breast milk of residents of the aboriginal communities and a health risk assessment using those data.

Additional monitoring of wet and dry deposition was also proposed. The Board deals with that matter in section 7.3 of this report.

To support its request, the Indian First Nations provided evidence about concentrations of contaminants in the Great Lakes and made reference to concentrations of contaminants in the High Arctic. In both cases, contaminants were detected in ecosystem components at considerable distances from the sources from which they are assumed to originate. The Indian First Nations argued that the natural resources on which they depend, and they themselves, are subject to contamination from industrial sources, that this is potentially harmful to them, and that a monitoring program is required to determine the extent to which they may be affected. The Indian First Nations noted that Chem-Security is proposing to add to the total quantity of regional emissions of contaminants and that it is the agent for an enterprise that is partially owned by the Alberta Government. They argued that for these reasons Chem-Security should be required to undertake the proposed regional monitoring program or that it should initiate and lead the joint funding and implementation of such a program by all regional emitters of contaminants.

As examples of similar regional monitoring programs, the Indian First Nations cited a state-wide monitoring program in Minnesota and the Northern Rivers Study just beginning in Alberta, Saskatchewan and the Northwest Territories. Both programs are jointly funded and managed by federal and provincial, territorial or state governments.

Chem-Security's position was that its existing and proposed monitoring program is adequate to provide information about concentrations of contaminants that might be expected to have originated from the Treatment Centre in environmental components and people. Furthermore it suggested that the program is adequate to detect increasing contaminant concentrations in environmental components in the vicinity of the Centre, and in workers at the Centre. This would provide early warning of any departures from expected performance and allow remedial measures to be undertaken before risks to human health or the environment reach unacceptable levels. Chem-Security pointed out that this had happened in the case of fugitive emissions of chlorinated hydrocarbons. Chem-Security suggested that its responsibilities do not

extend beyond the objectives of the existing monitoring program. In its opinion, regional monitoring aimed at cumulative effects, as proposed by the Indian First Nations, is properly the responsibility of government.

The Board agrees that extension of the applicant's existing monitoring program to include the area occupied by the communities around Lesser Slave Lake would not be necessary to detect the presence in the ecosystem of contaminants originating from the Centre. Furthermore, the communities are 60 km or more from the Centre and at those distances it is unlikely that concentrations of contaminants in environmental components would reach high enough levels to be detected if the sole source of the contaminants were the expanded Treatment Centre. As noted in section 7.4.2, there are many other sources of contamination in the area, and the contribution of the Treatment Centre to contaminant concentrations at the communities is likely to be small. The same reasoning applies to contaminants in people. Therefore, any results of measuring contaminant concentrations in environmental components or people resident in the communities could not be related to emissions from the Treatment Centre.

Since it is unlikely that the contaminants that may be present in ecosystem components, including food species and water, and in residents of the aboriginal communities could be attributed to any single source, the Board is of the view that making any one emitter responsible for a regional monitoring program would not be reasonable. Therefore the Board is not prepared to require Chem-Security to undertake the regional biological-effects monitoring program proposed by the Indian First Nations.

This decision does not mean that the Board rejects the concerns about environmental contamination expressed by aboriginal people resident in the region. Such concern is understandable. The Board believes that any responsible authority making a decision about the desirability or need for a regional monitoring program would require much more evidence before it than the Board has seen or heard in connection with Chem-Security's application. For example, the Board believes that a great deal of information is available as a result of generally available knowledge about emissions from the types of industrial and domestic sources present in the region as well as from operator's programs to monitor both their emissions and receptors in the vicinity of their sources. Cooperation to combine this information and these programs into a regional monitoring program might appear to be desirable. However, where sources differ greatly in the composition of their emissions, this may be impractical. Furthermore, the Board considers that a careful examination of the comparative benefits of conducting extensive monitoring programs as opposed to taking action to reduce or eliminate emissions of contaminants would be desirable before any responsible body makes a decision to undertake either.

The Board has offered these observations about what would be required to make a decision on whether or not to conduct a regional monitoring program to illustrate that making such a decision would not be a simple matter. While the making of such a decision and, should it be positive, the action required to implement it is beyond the Board's jurisdiction, the Board does intend to bring the matter to the attention of Alberta Environment. However, because of

the nature of the Treatment Centre, the Board does not consider that the development and implementation of a regional monitoring program would justify large reductions in Chem-Security's monitoring program currently under way or as proposed for the expansion.

7.7.3 Specific Issues with Respect to Chem-Security's Monitoring Program

7.7.3.1 Spatial Distribution of Monitoring Stations

In explaining the use of the SULDEP model for sulphate deposition, the applicant said that results were used 5 years ago to select locations for monitoring stations. Use of the model had to rely on meteorological data from elsewhere. Recent use of the ISCST model with site-specific meteorological data, suggests a somewhat different geographical pattern of deposition of contaminants. Chem-Security stated that it will review the distribution of monitoring stations in relation to this new information during the next year.

The applicant explained changes to the location and number of monitoring stations that had been made since the program began. The changes had been made when monitoring results detected unexpected concentrations of contaminants; stations were added to provide more information. Examples were: addition of stations to detect chlorobenzene and PCBs and choice of more representative (unaffected) sites for controls; additional monitoring of herbivores (voles) when dioxins and furans were detected in vegetation; and a readjustment of the entire distribution of sample sites after the new stations were added.

The Board is satisfied with the applicant's rationale for the placement of monitoring stations, with the reasons for the changes in location and number of stations made in the past, and with the applicant's intention to review the distribution of stations with respect to the ground-level concentrations of contaminants in air predicted by the ISCST model. The Board believes that approval of changes in monitoring program design by Alberta Environment as part of the annual licence review process will ensure the continued effectiveness of the program.

7.7.3.2 Stack Monitoring

A plant may be equipped with the best possible pollution control equipment and the most sensitive and accurate equipment to monitor physical and chemical variables in the stack, but unless the monitoring equipment functions effectively, the operators will not be aware of what is happening in the pollution control train. Without this awareness, it would be impossible to achieve optimum operation of the pollution control train. If the monitoring equipment is functioning effectively, the other requirement for optimum operation of the plant is that the workers operating the plant be sufficiently well trained that they can take appropriate and timely action when monitoring results indicate that it is required.

The applicant described the procedures that are in place in the existing Centre to fulfill these needs and the procedures that would be in place to the same end in the expanded Centre. Stack monitoring is continuous. Amongst the variables monitored are carbon monoxide, oxygen,

sulphur, temperature and pH in various stages of the incineration and pollution control process. Results of this continuous monitoring are made available to Alberta Environment. Operators' monitoring and daily logs are checked by the applicant's engineering staff. Operators undergo a period of 2 to 3 years general on the job training, and additional training related to workplace health and safety and regulatory permit requirements.

The Board is satisfied that the applicant's procedures to monitor and control its incineration process are well designed and that its operators are trained to operate its equipment and respond to deviations from normal operation. The Board is also confident that Alberta Environment's review of the continuous monitoring data will reveal any unusual episodes or recurrent deviations that might indicate a need for remedial action. In such a case, the Board is confident that Alberta Environment would review the matter with the applicant and require remedial action as appropriate.

7.7.3.3 Frequency of Sampling Trace Contaminants

Chem-Security samples emissions of contaminants that are present in very low concentrations quarterly. This includes most of the 67 contaminants that it selected for analysis. Chem-Security samples and analyses the same contaminants in ambient air annually, with the exception of PCBs and total suspended particulates which it samples over a 24-hour period every 6 days.

SHERC suggested that quarterly and annual analysis is insufficient to provide an accurate account of what is being emitted. It proposed that sampling and analysis of both emissions and ambient air should be conducted at least monthly, for all contaminants.

The Board recognizes that sampling and analysis for contaminants present in low concentrations is difficult and expensive. The Board believes that, in normal circumstances, the frequency of sampling should be restricted to what is necessary to provide assurance that the Centre is operating within design and regulatory criteria. The Board recognizes that if a problem is encountered, as was the case with fugitive emissions, additional sampling may be required to investigate its cause.

The Board is also cognizant of the need to ensure that sampling is representative. Although more frequent sampling can help to achieve representativeness, timing sampling so that it occurs during typical operation is probably as effective in that regard and provides a better return of information for effort expended. By typical operation, the Board has in mind every day operation when feedstock typical of the bulk of the waste treated at the Centre is being processed. It does not mean either operations at peak efficiency planned for demonstration purposes or operations during which unusual problems are encountered. The Board has required that changes in feedstock be accompanied by substantial investigative work. Where this is not a consideration, the Board recommends that sampling of emissions and ambient air for contaminants present in low concentrations be timed to occur during typical operations.

7.7.3.4 Building Wake Effect

The Board reviewed SHERC's recommendation of placement of a monitoring station within the area that might be affected by the building wake effect during emergency venting. The Board's conclusion and recommendation are provided in section 7.2.3.

7.7.3.5 Fugitive Dust and Particulates

The issue of the contribution of resuspended dust to the dispersion of contaminants is discussed in section 7.1.7.3. In raising the issue, SHERC recommended placement and operation of high volume samplers to collect fugitive dust and subsequent analysis of the samples for contaminants. The Board concluded that this is not essential. The matter of the concentration and composition of particulates released during emergency venting is dealt with in sections 7.1.6 and 7.2.3; the Board's recommendation with respect to the matter is given at the end of section 7.2.3.

7.7.3.6 Surface and Groundwater Quality

The principal features of the applicant's program to monitor surface water quality are described in section 7.5.1.1 and the results of the monitoring to 1991 are discussed there. Alberta Environment asked a number of questions about the distribution of surface water quality monitoring stations downstream of the existing Centre and the reasons for the choice of locations made by the applicant. The applicant explained that the primary reason for the choice of locations was to intercept any contaminants originating from the Centre that may be captured by surface water and moved away from the Centre. The applicant also explained that contaminants chosen for analysis were those that might be expected to originate from the Centre and be present in surface water. There is no plan to modify the design of the monitoring program if and when the proposed expansion comes into operation. The applicant suggested that the present design should be adequate, but that it will continue to review the program and its results annually with Alberta Environment and with the Swan Hills Citizens Liaison Committee. Any desirable changes would be made after discussion at the annual meetings.

The Board is satisfied that the current design of the monitoring program for surface water is adequate for the foreseeable future. The Board is further assured that annual reviews as described by the applicant will be adequate to deal with unexpected changes in Centre operations or contaminant levels.

The applicant's groundwater monitoring program and its results to date are described in section 7.5.1.2 of this report. The Board concluded that potential contamination of shallow groundwater would first be detected in surface water and that the only potential for contamination of deep groundwater is by leaks from the injection well or around its casing. In the opinion of the Board, the sampling and analytical methods and the selection of parameters for the applicant's groundwater monitoring program are adequate to detect any contamination within a short time of its appearance.

7.7.3.7 Soils and Vegetation

The applicant's monitoring program is intended to detect acceleration or rising trends in the concentrations of contaminants in soil and vegetation. Detection of rising trends, or more rapid accumulation than is estimated in the applicant's risk assessment, warns the applicant that a reconsideration of risk is required. Significant increases in contaminant concentrations would lead the applicant to take steps to reduce emissions of the contaminants concerned. The sampling of soil, vegetation and terrestrial animals was conducted, and is planned to be conducted in future, at the same locations in order to provide the most accurate data possible on the partitioning of contaminants between environmental media and their movement along environmental pathways. The design and implementation and the results to 1991 of the monitoring of soils are discussed in section 7.5.1.5 of this report and those of vegetation in section 7.5.1.6.

The Board reviewed the design and the results of the applicant's monitoring programs for soil and vegetation and noted that there is substantial variation in the data that is not attributable to emissions from the Treatment Centre. Part of this variation may be called the background or pseudo-replicate contribution; it arises because the soil and vegetation sampled at any period is disturbed or destroyed. Subsequent samples are not true replicates with respect to variation other than that occurring with time. Seasonal and calendar year variation also contribute to total variance but are more easily accounted for. The Board recognizes these limitations of the design of the applicant's monitoring programs but acknowledges that the problem of pseudo-replication is often unavoidable in programs of field observation and even in field experiments. The Board believes that the design of the monitoring program is consistent with what is achievable and considers it adequate to detect increases in contaminant concentrations should they appear.

7.7.3.8 Terrestrial Animals

Although the applicant has in place a program to monitor concentrations of contaminants in soil, water and vegetation, the movement of contaminants through food chains and the potential for bioaccumulation at the higher trophic levels makes it desirable to monitor concentrations in herbivores and carnivores. In the terrestrial food chain, the herbivorous red-backed vole was the species chosen for systematic monitoring. Other species are analyzed for contaminants opportunistically when individuals are captured.

The reasons for selecting the red-backed vole as the principal herbivorous subject of monitoring are discussed in section 7.5.1.7. In that section, the concentrations of contaminants detected in voles up to September 1991 are also discussed.

There was no program of systematic monitoring of terrestrial carnivores. Monitoring of terrestrial carnivores for contaminants is obviously desirable because of their high position in the food chain. Unfortunately, as the applicant observed, the populations of carnivores that have home ranges in the vicinity of the Centre are small and could be more severely impacted by

destructive sampling than by the effects of the Centre. Furthermore, numbers are too small to allow adequate replication in time and space in a monitoring observational design. For this reason, more than one intervener suggested enlisting the aid of local trappers to secure tissue samples from captured carnivorous species. The Indian First Nations also suggested the use of road kills.

During the period of monitoring, from 1986 to 1991, the applicant made several changes in the number and distribution of monitoring stations at which voles are captured for analysis and it indicated that it planned further adjustments in 1992. The reasons offered for the changes were:

- to provide for more distant control sites because the original controls were close enough to the Centre that traces of PCBs found in the control samples may have originated from it;
- to provide additional samples of voles for analysis for dioxins and furans;
- to add supplementary stations for the monitoring of PCBs and chlorobenzenes after discovery of the problem of fugitive emissions of those substances; and
- to adjust the observational design to take into account the plume dispersal and deposition pattern that is actually experienced as opposed to that predicted by the SULDEP model.

As discussed in section 7.5.1.7, the applicant has conducted surveys to establish baseline estimates of population densities of ungulates and has obtained evidence from the literature about historical population densities of grizzly bear. In addition, the applicant has access to trapping returns which provide quantitative, but not necessarily representative, information about populations of fur-bearing mammals.

The Board has reviewed the design of the applicant's present and proposed program to monitor contaminants in herbivores and finds them adequate to detect increasing concentrations of contaminants should those occur. More specifically the Board concludes that the selection of the red-backed vole as the subject for systematic monitoring was justified. The Board has concerns that changing the observational design of a monitoring program once it is under way can reduce the ability of the user to make comparisons and draw conclusions but the Board finds that the various modifications to the observational design of the applicant's program that were described in written evidence and discussed at the hearing were well-founded. The Board believes that if unanticipated contamination is detected, as was the case with PCBs, that the applicant, in concert with Alberta Environment will not only take measures to control the release of contaminants but will also modify the monitoring program to increase its power of resolution should that be necessary.

With respect to terrestrial carnivores, the Board concludes that the numbers present in the vicinity of the Treatment Centre are too small to provide a reliable supply of animals for repeated destructive sampling. Sampling from such small populations would almost certainly have more adverse impact than the Centre is likely to have. Evidence on trapping returns from registered traplines adjacent to the Centre show that even for the most abundant carnivorous species, it would be very difficult to obtain a large enough sample each year to provide interpretable data. This might not be such an obstacle to a broad regional monitoring program not specifically concerned with any one source, as is the case in the Minnesota program cited by the Indian First Nations, but it is sufficient to obstruct any attempt to develop a reliable monitoring program in the area in which one might reasonably expect effects of the Treatment Centre to be detectable. In addition, there may be practical difficulties in obtaining fresh samples of internal tissues of trapped animals that have not been subject to secondary contamination. However, the Board acknowledges that occasional analysis of tissues from trapped carnivores may supplement the data available to the applicant on bioaccumulation of contaminants by animals living near the Centre and would not discourage the applicant from conducting them.

7.7.3.9 Aquatic Resources

In the aquatic food chain, the applicant has monitored, and intends to continue monitoring, the faunal and trophic composition of benthic invertebrate communities and the chemical composition of sediments in the Coutts River system downstream of the Centre. The communities include herbivores, carnivores, omnivores and species that feed on detritus. The applicant is also taking brook trout from Chrystina Lake annually for contaminant analysis and it intends in future to analyze white suckers as well.

The design of the monitoring programs and their results to date are discussed in section 7.5.1.3. Although no contaminants attributable to emissions from the Treatment Centre had been detected by 1990, the Board has reviewed the design of the programs and has concluded that they are adequate to detect any future contamination that may originate from the Centre.

7.7.3.10 Human Health

Monitoring of human health is dealt with in section 7.6.

7.7.4 Consultative Review and Revision of the Monitoring Program

The design and implementation of the monitoring program is managed by a committee of Chem-Security staff. This committee receives recommendations from the company's consultants, the Swan Hills Citizens Liaison Committee, the Town of Swan Hills and Alberta Environment. Any proposals to modify the monitoring program are submitted to Alberta Environment for approval because they may require amendment of the company's operating licence. The Indian First Nations expressed a strong desire to be involved in consultations with respect to the design, implementation and results of the monitoring program through the Swan

Hills Citizens Liaison Committee, provided that they would have an equal vote in determining its recommendations to Chem-Security and Alberta Environment. During the hearing, Chem-Security invited SHERC and the Indian First Nations to participate in consultations with respect to monitoring. Both the Indian First Nations and SHERC suggested that their effective participation in the Swan Hills Citizens Liaison Committee and its activities with respect to monitoring would require that they engage qualified consultants. They went on to say that this would not be possible unless Chem-Security were to bear the cost.

The Board is satisfied with the applicant's consultative arrangements, including its invitations to participate to SHERC and the Indian First Nations, assuming that Alberta Environment participates actively in the deliberations of the Committee. The Board concludes that on-going consultation with, and approval by, Alberta Environment will ensure that the monitoring program is designed and conducted in a manner that will protect human health and the environment. The Board believes that matters of the cost of participation in the review of monitoring through the Swan Hills Citizens Liaison Committee should be settled by Chem-Security and the other participants, without intervention by the Board.

7.8 Conclusion

In the earlier subsections of section 7, the Board has reviewed all the evidence before it about predicted emissions from the proposed expanded Treatment Centre and their possible effects, has reached detailed conclusions, and has developed specific recommendations and requirements. Here, at the end of the section, it may be appropriate for the Board to step back and offer a more general conclusion.

Chem-Security has gone to considerable lengths to estimate what emissions from the proposed expanded Centre might be, how they may be dispersed, how contaminants present in the emissions may become distributed throughout the environment, and the exposures to those contaminants which people, animals and plants may experience. Chem-Security has, using very conservative assumptions, also estimated the risks to the health of humans and wildlife species which those exposures to contaminants might engender. Its conclusions are that, provided the new kiln is constructed and operated as proposed, risks to human health and the environment would be acceptable.

The Board accepts this conclusion with some relatively minor reservations that are explained in detail earlier. However, the Board notes that both the assessment of risk and the operation of the proposed kiln are subject to uncertainty. To illustrate: the applicant had been confident that the original Centre would operate as planned, but an unforeseen problem arose when fugitive emissions of chlorinated hydrocarbons from waste handling facilities at the Centre exceeded expected amounts. Chem-Security has recognized uncertainty in output from the Centre all along and has put in place an extensive monitoring program to detect departures from expectation. The program was effective in detecting the problem of fugitive emissions. Detection of departures from expectation led the company to reassess possible effects and to take appropriate action.

The Board accepts that a comprehensive monitoring program is a prudent and appropriate method of dealing with uncertainty of output and has made some more detailed recommendations about the monitoring program. However, the Board recognizes that there may be uncertainties of input as well as output. Chem-Security has assumed in its assessment that the composition of the waste stream to be incinerated in the proposed kiln will lie within the range treated in the existing kilns. The Board has required that, if the composition of this feedstock changes significantly, Chem-Security conduct test burns and reassess predictions of effects of emissions in consultation with Alberta Environment.

The Board believes that the assurance that these two methods of managing uncertainty provide against adverse effects on human health and unacceptable effects on the environment was a very important factor in determining whether or not the proposed expansion of the Treatment Centre is in the public interest.

8. DISPOSAL OF SOLID WASTE AT THE CENTRE

The technology selected for the disposal of solid waste residue (flyash and incinerator ash) produced from the operation of the Treatment Centre utilizes secured landfill cells. A number of issues need to be addressed in the assessment of this technology. These include:

- the type and toxicity of waste at the time it is disposed of;
- the security of the landfill cells during the period of active use;
- the security of the landfill cells after they are filled; and
- the possible effects on groundwater or land use.

Solid waste disposal was considered in the initial siting studies undertaken by the Government. This included specific site evaluation with respect to geological and hydrological characteristics, as well as alternative land uses and general suitability. Part of this process included a review by a panel of experts. Environmental factors that were considered related to the issue of landfill cells included the following:

- a relatively impervious site characterized by thick clay soils;
- the remote location of the site away from population centres; and
- lack of conflicting land uses.

Chem-Security included a secure landfill site as an integrated part of the Treatment Centre, and stated that the rationale used in the development of the landfill is the disposal of treatment residue so that it is securely contained. Upon closure of a landfill cell, it will continue to be monitored by the applicant for 20 years, subsequent to which responsibility will revert to the Province.

8.1 Types and Toxicity of Waste

The types of waste to be included in the solids committed to the landfill are summarized in Table 2 of the application. Those materials pertinent to the proposed expansion are incinerator kiln ash and incinerator flyash. The flyash would consist of salts from neutralized scrubber fluids and particulate matter. Some wastes must be stabilized in order to be suitable for disposal. According to Chem-Security, quantities arising from the proposed expansion would be:

Solid Waste Stream	Max. Rate (kg/hr.)	Av. Rate (kg/hr.)
Incinerator Kiln Ash	3,300	1,000
Neutralized Salts	4,200	2,100

As stated in the application, the burnt-out solids and flyash from the kiln would be tested in accordance with the clean air and clean water licences. The material would be subjected to

various tests to simulate a 200-year exposure to the elements, acid rain and grinding movement. Included in the process is an approved Leachate Extraction Procedure. If the residue meets certain criteria, it would be placed directly into a landfill site. If not, it would be stabilized on site, re-analyzed and placed in the landfill cell when the criteria are met. The incinerator ash generally would not require stabilization, but the flyash would be stabilized as required.

Chem-Security stated that a general characterization is made of the chemical nature of the material to be committed to the secure landfill. It would be substantially organic free and the prime constituents of concern would be heavy metals which are intended to be immobilized via stabilization.

The Board is satisfied that Chem-Security has an acceptable system for analyzing the solids to be committed to landfill cells and ensuring that they meet standards consistent with the operating licences from Alberta Environment.

8.2 Landfill Cells

8.2.1 Design

According to Chem-Security, the secure landfill cells are constructed with the capacity of 6,000 m^3 for each cell. Up to four cells per year would be required after the expansion, which the site could accommodate for a 20-year period. The cells would be lined with high density polyethylene (HDPE) between abrasion resistant geotextile layers, but the liner is only considered as a secondary level of protection. The primary agents of protection would be the underlying clay and an impermeable covering.

The stability of this clay was raised as a concern by EFONES at the hearing. It mentioned the loss of the impervious characteristics of the clay when exposed to pulp mill effluents. EFONES recognized that the stability of the clay would only be retained if the landfill cells were maintained in a dry state as intended in their design.

8.2.2 Proposed Control Measures

According to the applicant, a number of precautions are to be taken to assure the landfill cells are kept in a dry state. The landfill cell design includes a liquids collection system located above the HDPE liner. Any liquids which may enter the cell are collected at the bottom of the cavity above the liner and would be removed for treatment and/or disposal. In addition, a leachate monitoring system is located below the HDPE liner to check for leaks. This system was installed as a safety backup since it was intended that no liquid would enter the landfill both during operation and after closure.

To ensure the absence of liquid during operation, a portable enclosure is placed over the active cell. This enclosure remains in place until the cell is filled. At that time, the cell is covered with an impervious HDPE layer which is heat welded to the HDPE liner, with the

intention of creating a fully sealed envelope around the cell. The portable enclosure is then moved on to the next active cell site.

8.2.3 Closure and Abandonment Procedures

Chem-Security stated that after a cell is filled, the procedure is modified. Once the cell is sealed with HDPE, it is covered with relatively impermeable clay and soil and revegetated. Any future use that would disturb the covers of the closed landfills would be restricted.

The current knowledge of stabilization technology as practised at the Treatment Centre, results in a projected 200-year minimum stable life for the material if exposed to the elements, based on the testing carried out at the time of fixation.

According to the Joint Venture Agreement, responsibility for the care of the site beyond the 20-year closure phase passes to the Alberta Government. Consequently, procedures for long-term care will be as prescribed and implemented by Alberta Environment and will incorporate improved knowledge of the stabilization process as it becomes available.

8.2.4 Monitoring of Landfill Cells

The monitoring of the landfill cells is intended to address security during operation and integrity after closure.

Chem-Security stated that in the short-term, or during the operational period, a monitoring system detects the entry of any liquid into the cell. It consists of a leachate collection system in the cell, a leachate monitoring system below the HDPE liner, and a groundwater monitoring network. Since it is the intent of the design that these cells be maintained in a dry condition to preclude the migration of leachate, the detection of liquid would indicate an operational problem. This, in fact, has occurred at the existing operation and it resulted in alterations of the procedures to prevent its recurrence. A movable enclosure was constructed and is kept in place over the active cell prior to a final cover being installed.

After cell closure, monitoring has to be maintained. For the first 20 years after the closure of a given cell this would be the responsibility of the applicant and if deterioration and leakage are determined, it would be the responsibility of the applicant to undertake repairs. In the longer term, the perpetual care and responsibility for monitoring is assumed by the Provincial Government. To assist in this undertaking, provisions have been made for a cell monitoring and remedial fund.

8.2.5 Views of the Board

The Board is of the view that the applicant has demonstrated that its design of secure landfill cells is consistent with the current state of the technology. It is satisfied that the material stored should remain in a stable condition for a very lengthy period, as projected by Chem-

Security. Indeed, since the projection is based on a simulated exposure of 200 years to leaching and physical stress, the enclosure in a dry environment should extend the effective life indefinitely.

The Board expects the applicant to continue the efforts to ensure safe disposal of the solid waste, and to work with Alberta Environment to ensure the adoption of new technology as it becomes available. Towards this end, the Board believes that ongoing satisfactory monitoring is important, and recommends that any approvals from Alberta Environment contain appropriate requirements.

8.3 Possible Effects of Disposal of Solid Wastes

Chem-Security stated that the final disposal of solid waste occurs at the point where further treatment is no longer necessary, as demonstrated by the relevant leaching tests of either the waste or the waste in a stabilized form. At the time of disposal, wastes which have passed the test do not constitute hazardous materials.

Concern was raised by several interveners regarding the unproven performance of the landfill cells over an extended period and the need for continued long-term monitoring was identified. Specific reference was made to possible effects on groundwater. Their concern was that water originating at the surface may migrate through a landfill, interacting with the fill material to form a "leachate". This liquid, containing chemicals originating from the landfill, may seep through the ground and contaminate groundwater. To contaminate groundwater in the vicinity of the Treatment Centre in this manner, water would have to pass through to a landfill cell.

The Board, on the basis of information provided at the hearing, is aware that stormwater is diverted from the landfill cell area to the local watershed. The cells are operated and designed so that liquid does not have access and this is assured by ongoing monitoring. During the siting evaluation, a major consideration was the selection of a site with low permeability. Also, even if liquid had access to the cells, the materials placed in the cells have passed a leachability evaluation test to assure that any leachate formed would be relatively dilute and troublefree. If this leachate were to pass into the ground, it would likely be confined to the perched (isolated) water table near the surface, where the migration rate is a few centimetres a year.

Having regard for all relevant aspects of the issue, the Board is satisfied that the precautions to minimize short and long-term impacts on the groundwater are such that potential effects would be negligible.

With respect to possible effects on future land use, once the cells are filled, they will be covered and revegetated. Land use options at the Swan Hills site are fairly limited, and a conflict of future land use with the perpetual care status is considered unlikely. This is further assured by the reversion of the land to the Province after closure conditions have been satisfied. As a result, the Board is satisfied that the landfill would not give rise to significant conflict with

future land use in the area. However, to ensure effective notice, the Board recommends that upon closure, the site should be permanently marked and recorded in the appropriate land record offices. Also, the vegetation cover should be limited to shallow-rooted species in the initial planting and through subsequent care, so as to prevent the possible penetration of the protective liner by root action.

8.4 Conclusions Respecting Disposal of Solid Waste

The Board concludes that Chem-Security's plans regarding the design, construction, operation, monitoring and closure of the secure landfill are adequate. Significant problems should not be expected as long as the plans are carefully adhered to on an ongoing basis.

The Board believes the existing regulatory framework and the continued involvement of Alberta Environment will be sufficient to ensure the safe operation of the landfill site.

9. DISPOSAL OF LIQUID WASTE AT THE CENTRE

9.1 Types of Waste

The applicant gave evidence that the proposed new kiln at the Treatment Centre would not generate waste that requires deep well disposal. All wastewater from the pollution control system attached to the proposed kiln would be reinjected into the kiln. The residue from the pollution control system would all be solid. The quantity of liquid process wastes that are currently injected into the disposal well might be reduced in future because some of the wastewater from the scrubbers attached to the existing kilns may be evaporated in the new kiln, thus decreasing the volume requiring injection.

According to Chem-Security the addition of the new kiln would not alter the availability or application of methods of treating liquid waste received at the Centre. These would continue to be treated as in the existing Centre. As is now the case, no untreated liquid waste would be injected into the disposal well. Although the volumes of some types of liquid waste treated at the Centre would increase after expansion, no new types of liquid waste are expected to be treated. Liquids treated at the existing Centre include organic liquids, acids, caustic liquids and sludges. Of these only organic liquids and sludges are incinerated and at least some of these would be destroyed in the proposed new kiln. The Board notes that because of the increased throughput, the amount of liquid waste stored and awaiting treatment on the site at any given time may increase after the proposed expansion. The Board also notes that the quantities of liquids used in small amounts at the Centre itself, such as cleaning fluids and lubricating oils, might increase slightly after expansion, giving rise to a small increase in the amount of waste liquids, sludges and containers generated there.

Construction and operation of the expansion would increase the labour force and would lead to an increase in the volume of washwater and sewage generated at the Centre. The sanitary sewer system at the Centre runs to a sewage treatment plant on-site southeast of the retention ponds to which surface runoff is routed by the site surface drainage system. The applicant reported that the capacity of the Treatment Centre is 45 m^3/day and that this should be large enough to accommodate the increased demand generated by the proposed expanded Treatment Centre. Treated water is discharged into the retention ponds.

The Board examined all the evidence respecting liquid waste that would be generated at the Treatment Centre or that might be received there as a result of the proposed expansion and concludes that Chem-Security had provided an accurate account of what would be present.

9.2 Surface Runoff

Chem-Security said that it designed the existing Centre so that runoff from the active plant area is collected in a series of ditches which drain into surface water retention ponds at the west side of the fenced area. The current active plant area is 90,000 m^2, most of which is paved. Expansion as proposed would add a further 6,000 m^2. Construction of the new kiln may

change surface characteristics in a manner that could alter the distribution of surface runoff and the design of the proposed expansion is intended to ensure that all surface drainage enters the retention ponds. The quantity of runoff could be increased because a larger number of trucks would be unloading and, consequently, washed at the expanded Treatment Centre. Water from truck washing is collected on a paved, curbed surface and directed to the retention pond. Water from the retention ponds is, and would continue to be, used in the incineration and pollution control process or tested, treated if necessary, and injected into the disposal well. One of Chem-Security's design objectives is that no surface water from the active areas of the plant site would enter off-site drainage systems.

The Board reviewed the applicant's site plans and the designs of the existing and proposed expanded Treatment Centre and concludes that the objective of retaining surface drainage from the active plant area on-site would be met by the proposed designs.

9.3 System Design

According to the terms of its operating licence, Chem-Security operates a deep injection well. The injection well is used for the disposal of treated aqueous liquids that come from the treatment processes and the incinerator scrubbers. Excess storm water runoff, if not used in the treatment processes, may be disposed of in this manner. The liquid waste is injected into two geologic formations 1.8 km below the ground surface where it is isolated from the biosphere. The total depth of the shaft is 2,045 m. SHERC drew attention to the Alberta Research Council document, Geographical Survey Department Bulletin 58, "Hydrogeology of the Swan Hills Area, Alberta: Evaluation for Deep Well Injection", 1989, by B. Hitchon, et al., in which the lateral movement potential for this deep formation is discussed.

In the opinion of the applicant, the principal hazard from deep well injection is the escape of waste liquid either to the surface or into aquifers at higher elevations (to a depth of 730 m) suitable for potable water use. To protect against these eventualities, the injection well is of a double well design with the injection fluid travelling through the inner tubing. The outer fibreglass tubing is separated from the inner tubing by an annulus filled with water. The outer casing is sealed to the surrounding rock with foamed cement. If a leak were to occur, the water level in the annulus, recorded on a 24-hour basis, would provide a warning. The warning, in turn, would require that injection cease and remedial work be undertaken. In addition, the injection head is monitored continuously by a pressure sensing device suspended inside the injection tube. This level has been shown over a four-year period to be lower than the liquid head of the usable water formations. Any leakage under these conditions would tend to be into the well.

The Alberta Trappers Association and EFONES questioned the safety and reliability of the injection well.

The Board accepts that the design and operation of the injection well is not a formal part of the application before it because the proposed new kiln would not generate liquid waste for injection. However, the Board notes that at least some wastewater and runoff arising from the expansion may have to be disposed of by injection and that the injection of treated liquid waste is expected to proceed as it does in the current operation. The Board has therefore reviewed all the evidence before it concerning deep well disposal. The Board is also aware that the design and construction of the well was carried out in a manner approved by the Energy Resources Conservation Board (ERCB) and that the operation of the well is subject to regulation and licensing by Alberta Environment. Prior to injection, liquids intended for deep well disposal have to be analyzed in the laboratory to ensure that the terms of the Clean Water Licence are met. Chem- Security is required to monitor daily water levels, injection pressures, injected volumes, operating time at the well site as well as physical and chemical characteristics of the liquid. The well's performance is reviewed annually and the report submitted to Alberta Environment.

The Indian First Nations indicated a concern that contaminants from the deep well could pollute Lesser Slave Lake and their local water supply. The lake and reserves are located over 60 km north of the Centre and the formations into which the residue fluids are disposed are at a much lower elevation than the lake. It is, therefore, unlikely there could be any adverse effect.

The Board recognizes that deep well injection requires careful monitoring by the responsible agencies. The Board concludes that the current licence and monitoring requirements have provided and will provide reasonable assurance regarding the safety and security of deep well disposal. The Board recommends that the ERCB and Alberta Environment maintain their careful surveillance of the operation of the well because of the long-term contamination of potable aquifers that could occur if it fails to operate as designed. The Board reviews the arrangements for the ultimate abandonment and closure of the well in section 13.3.

9.4 Spills and Accidental Releases

Spills or accidental releases can occur when waste is transported from one place to another, transferred from one container to another, or simply stored. Chem-Security acknowledged that any of these types of event could occur at its existing or proposed expanded Centre. It provided evidence in the EIA, supplementary information documents and at the hearing about its measures to reduce the probability of occurrence of spills and accidental releases and to deal with those that do occur.

The existing Treatment Centre accepts and treats a wide variety of organic and aqueous liquid waste supplied by waste generators in the province. Chem-Security has described its existing methods of handling and processing these wastes in its application. Some of these wastes may be incinerated in the proposed new kiln using similar operating protocols to those in use with the existing kilns. In addition, there are other liquids used at the Treatment Centre which contain contaminants and which may be spilled or released on site. These include liquid

process waste, washwater and sewage, and small amounts of substances such as fuels, paints, lubricating oils, pesticides and herbicides, some of which may be used in increased quantities at the proposed expanded Centre.

The transportation of waste to the Treatment Centre is discussed in section 10. Chem-Security stated that on arrival at the Centre, trucks are unloaded on a paved curbed area which drains through a ditch system into the on-site retention ponds. Any residue left after clean-up of a spill that occurred while unloading would be carried with surface water drainage to the plastic-lined retention ponds and kept on-site. In winter, snow is cleared from the site and placed in the retention pond area where it melts in spring and runs into the ponds. The entire operational part of the plant site is on concrete or paved surfaces which ultimately drain into the retention ponds. Therefore, the residue of any spill occurring during handling or in-plant movement of waste would follow that path. Any residue of a spill of process liquids, wastewater, sewage, or substances used at the Centre would follow the same path.

Chem-Security gave evidence that it had designed the Centre to minimize the occurrence of emergencies including leaks, but that it had also developed and tested contingency plans to deal with such incidents. Engineering design measures to reduce the incidence of leaks and spills include safety features to protect against power failures or equipment malfunctions, high level alarms on storage vessels, an inspection program that is continually updated and measures to contain melted snow and runoff from the work areas as described earlier. Emergency response plans are discussed in section 13.2 of this report. They include employment of trained emergency response teams stationed in Swan Hills, Edmonton and Calgary. The teams are provided with trailers carrying medical, communications, mechanical and cleanup equipment and supplies and are on-call during the hours that trucks bringing waste to the Centre are operating. Presumably the Swan Hills based team would also be called to on-site emergencies and would supplement the operational staff who are also trained to deals with spills, accidental releases and other problems that could arise during operation of the plant.

Several interveners asked questions about spills and emergency releases at the hearing. Although none of them suggested that Chem-Security's measures to prevent or respond to such events are inadequate, SHERC did recommend that:

> "At least a semi-quantitative transportation consequence analysis be undertaken and plans for emergency response in the event of a spill be detailed. Other spill categories in addition to transport accidents are considered in the transportation risk assessment and a sensitivity analysis of risks be undertaken."

Chem-Security accepted this recommendation and said that it had already begun the work. It subsequently provided a copy of the analysis to the Board. The Board's review of the analysis, and of transportation risks in general, can be found in section 10.4 of this report.

The Board accepts that Chem-Security has taken appropriate steps to design its existing and proposed expanded Centre to reduce the risk of spills and releases and that it has in place contingency measures to deal with them should they occur. The Board recommends that the results of Chem-Security's consequence analysis be discussed with Alberta Occupational Health and Safety and Alberta Environment so that those departments may require any appropriate action to further reduce risks.

10. TRANSPORTATION OF WASTES TO THE CENTRE

Special waste from all parts of the Province of Alberta is transported by road to the Treatment Centre at Swan Hills. As operator of the Alberta Special Waste Treatment System, Chem-Security is responsible for operating both the Treatment Centre and the transportation system that links producers of special waste with the Centre. The projected number of special waste shipments to the proposed expanded Treatment Centre is expected to increase from the existing average of 1.3 trucks per day to an average of 10 trucks per day.

Public concerns raised over the transportation of special waste to the Treatment Centre during the applicant's public involvement program included: route selection, regulatory control, liability, security of loads, accident risks, emergency response plans, vehicle design, weather, driver training, driver fatigue, communication and emergency response times. Interveners at the hearing identified further concerns: transportation costs, volume of various waste types, the need for a semi-quantitative transportation consequence analysis and the need for a system for auditing the various aspects of the special waste transportation system.

The Board is satisfied that it has received sufficient reliable information to adequately assess the potential effects of the increased volume of special waste traffic which would result from the proposed expansion of the Treatment Centre. The experience of the applicant with the existing transportation system has facilitated a more comprehensive assessment of the proposed expanded system than would have been possible for a new facility at the same location.

10.1 Route Selection

Chem-Security stated that the transportation of special waste was one consideration that was weighed in the decision to site the existing Treatment Centre in Swan Hills. It is near the geographic centre of the province and waste destined for the Treatment Centre is transported by truck on paved provincial highways. Special waste trucks approach the Treatment Centre on a number of highway routes which are shown in Figure 10-1. Route I is the principal route between Nisku or Fort Saskatchewan and Swan Hills. Route II connects Fort McMurray to Swan Hills. Route III is the principal route from Grande Prairie and an additional principal Route IV would connect Hinton to Swan Hills after the expansion. According to the applicant the numbers of shipments are currently distributed 85 percent, 10 percent and 5 percent among Routes I, II and III. They would be distributed 72 percent, 19 percent, 7 percent and 2 percent among Routes I, II, III, and IV following expansion of the Treatment Centre. Outside the area shown on Figure 10-1, particularly for the southern part of the province, the trucks follow the main provincial highway system.

Figure 10-1 also shows several alternative routes that are used if any of the principal routes is out of service.

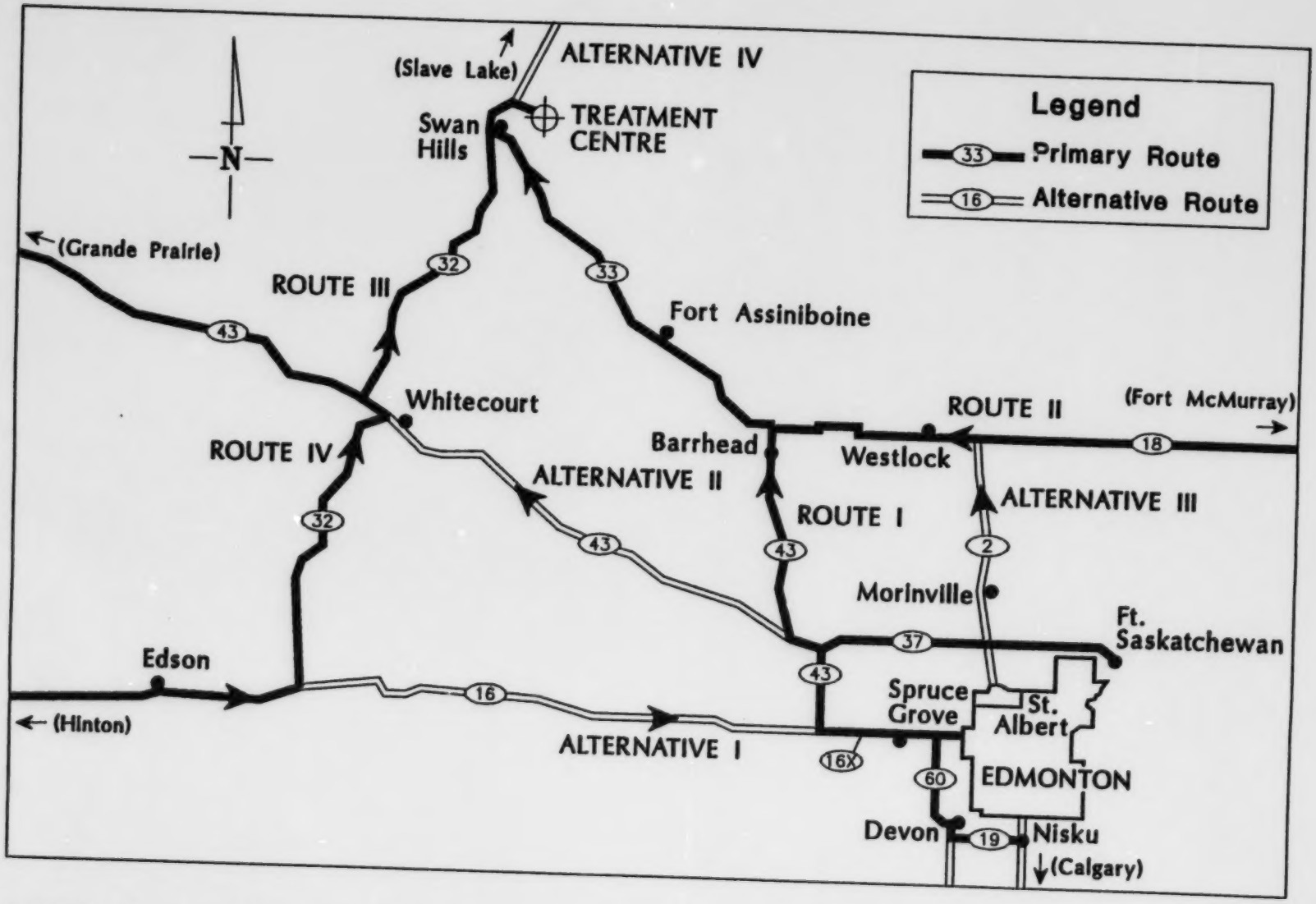


FIGURE 10-1 SPECIAL WASTES TRANSPORTATION ROUTES

The applicant conducted route surveys which assessed road quality which may influence the frequency of vehicle accidents, and the locations of intersections, river crossings, public property and human populations which may influence the severity of consequences should an accident occur. Road quality was assessed as excellent by Chem-Security on all of the chosen routes. Truck traffic volume within the region represents less than 15 percent of total traffic with the exception of Highway 16x (Route I) where truck traffic accounts for 19 percent of total traffic. Special waste vehicles destined for the Treatment Centre presently account for less than 1 percent of truck traffic volume in the region, even on Route I, where it is highest. Although special waste shipments would increase eightfold, the traffic volume associated with the Treatment Centre would still represent a very small fraction of the total traffic volume.

The Board agrees with Chem-Security's position that the impact of increased truck traffic during the construction and operating phases of the expanded Centre would not be expected to affect road quality. The provincial highway system in the region is maintained to a high standard and has the ability to handle much higher traffic volumes. Portions of the principal transportation routes used by Chem-Security have been recently upgraded.

Areas through which the four principal transportation routes pass are generally sparsely populated and present no unusual hazards with respect to river crossings, intersections and public property. The Board is of the view that the use of the provincial highway system and the routes selected by the applicant are the best available.

10.2 Regulatory Control

The many aspects of the transportation of dangerous goods (definition, safety requirements, vehicle inspections, containers, handling, shipping documentation, routing through urban areas, emergency response, inspection powers, penalties, compensation, liabilities, unloading and receiving) are governed by municipal, provincial and federal laws and regulations. The majority of the special waste transported to the Treatment Centre is classified as dangerous goods.

Alberta has adopted the Federal regulations which identify nine classes of dangerous goods summarized as follows:

CLASS 1 - *Explosives* - There are five divisions within this class.

CLASS 2 - *Gases* - There are four divisions within this class.

CLASS 3 - *This class has three divisions of flammable liquids, each of which are determined by flash points.*

CLASS 4 - This class has three divisions:

4.1 Flammable solids
4.2 Substances liable to spontaneous combustion
4.3 Substances that on contact with water emit flammable gases

CLASS 5 - This class has two divisions:

5.1 Oxidizing substances
5.2 Organic peroxides

CLASS 6 - This class has two divisions:

6.1 Poisonous substances
6.2 Infectious substances

CLASS 7 - Radioactive materials

CLASS 8 - Corrosive materials

CLASS 9 - This class has three divisions

9.1 Miscellaneous dangerous goods
9.2 An environmentally hazardous substance
9.3 A dangerous waste

The applicant identified the distribution of present and future special wastes by "Dangerous Goods Class" and shipment distribution percent as shown in Table 10-1. Class 1, 2 and 7 substances are not included in the special wastes shipped to the Treatment Centre.

The regulations dictate procedures and standards for the transportation of dangerous goods. Chem-Security stated that it is responsible as the consignor (shipper), as the carrier (road vehicles), and as the consignee (receiver) of the special waste and must conform to all the acts and regulations relating to the transportation of dangerous goods. In some areas, it has implemented more stringent policies that go beyond the regulatory requirements to better control transportation operations.

The Board considers that the existing regulatory framework, under the Transportation of Dangerous Goods Control Act and other acts and regulations, will be sufficient to safeguard the public interest in the transportation of special waste to the proposed expanded Treatment Centre.

TABLE 10-1

DISTRIBUTION OF WASTES BY DANGEROUS GOODS CLASS

Special Wastes Categories		Dangerous Goods Class	Shipment Distribution Present %	Future %
Drum	Class 9:	Dangerous Waste Products	65	20
	Class 4:	Flammable Solids	0	0
	Class 5:	Oxidizing and Organic	1	1
Bulk Liquid	Class 9:	Dangerous Waste Products	9	12
	Class 6:	Poisons	0	0
	Class 8:	Corrosive Substances	1	0.5
	Class 3:	Flammable Liquids	9	9.5
Bulk Solid	Class 9:	Dangerous Waste Products	4	31
	Class 6:	Poisons	0	0
	Class 8:	Corrosive Substances	1	1
Sludge	Class 9:	Dangerous Waste Products	0	15
Non-Regulated	Not under any specific class		10	10
			100%	100%

10.3 Chem-Security Procedures

The applicant described the measures it has undertaken to promote safety in the collection and transport of special waste and to minimize the consequences of any accidents that do occur.

10.3.1 Materials Handling

Chem-Security said that it operates a waste collection and transportation system that includes two waste storage warehouses and transfer stations at Calgary and Nisku. The transfer stations accept waste from small quantity generators and assemble full loads for transport to the Treatment Centre. The system can accommodate the full range of waste volumes, from small domestic to large industrial sources. Householders may deliver their hazardous waste to special community depots or take advantage of special waste collection events such as the Toxic Roundup. Small quantity industrial generators may haul small loads to the transfer stations directly or employ a broker to collect and transport waste to the transfer stations. Large quantity generators may also transport partial loads to the transfer stations or have Chem-Security haul full loads directly to the Treatment Centre.

The applicant assured the Board that all waste remains in sealed drums or other closed containers during storage and handling at the transfer stations. Thus, barring container failure accidents, there is little risk of fugitive emissions at the transfer stations.

The provisions of the Transportation of Dangerous Goods Control Act requires Chem-Security to conduct the identification, classification and packaging of special waste according to established procedures. Chem-Security's procedures for sampling incoming waste are discussed in section 7.1.5.1 of this report. The company must also follow established practices for the safe transport of small packages, drums, bulk liquids, bulk solids and transformers. Chem-Security stated that it currently uses three kinds of trucks. Bulk solids are carried in either combined 3-pivot or 2-pivot trailers, bulk liquids are carried in bulk liquid semi trailers and materials in drums are carried in specially designed combination trucks. Chem-Security would add sludge combination truck trailers to its operations following the proposed expansion.

The Board is satisfied with respect to the materials handling plans as described by Chem-Security.

10.3.2 Driver Training

The applicant indicated that all drivers that contract to transport special waste for Chem-Security are trained in company policies and procedures, occupational health and safety, regulations governing the transport of hazardous goods, defensive driving, air brakes and crane operation, first aid, the use of self-contained breathing apparatus, and emergency response. Chem-Security complies with the safety provisions of the National Safety Code under the Motor Vehicle Act and the Transportation of Dangerous Goods Control Act. Training sessions and regular meetings are organized to maintain driver awareness of policies and procedures.

The applicant has also implemented specific measures to prevent accidents that could result from driver fatigue. Drivers are limited in the daily, weekly and fortnightly number of hours they may drive and compliance is monitored. Loading and driving are limited to normal working hours. Finally, Chem-Security maintains direct telephone communication with drivers which allows the company to reroute drivers or delay travel in the event of poor driving conditions due to weather.

Chem-Security said it subcontracts independent truckers during periods of peak demand. Under these circumstances a representative of Chem-Security oversees the loading of the contract vehicle to ensure that normal procedures are followed. The proposed expansion could result in an increase of one or two contract carriers. They would normally be used to carry low contamination soils in bulk solid carriers or dump trucks. Other materials would be carried by drivers working exclusively for Chem-Security.

Chem-Security's present approach to driver training and related controls and its plans for these matters after the proposed expansion is in operation are acceptable to the Board.

10.3.3 Emergency Response Plans

The applicant stated that it maintains three emergency response teams based in Swan Hills, Nisku and Calgary that are available to respond to an emergency anywhere in the province. Personnel receive offsite training in emergency response procedures at specialized facilities and attend monthly training sessions. In the event of an emergency in the transportation system, it is the responsibility of the local authorities, highways department, fire departments and police personnel under the Transportation of Dangerous Goods Control Act and regulations to provide the primary response team and to be in charge. Chem-Security response teams and staff are prepared to assist the primary emergency response teams. Chem-Security's emergency response programs provide for information documentation carried in the vehicles, communication and reporting protocols, safety of employees and public, minimization of damage to environment and properties, and reporting to government officials and authorities.

Chem-Security stated that it has operated the existing transportation system for over four years. During this period its emergency response team has only been activated once. The procedures are under constant review and evaluation.

The Board concludes that the procedures and measures undertaken by Chem-Security in the collection and transportation of special waste are satisfactory and should minimize both the number of accidents and the severity of consequences of any accidents that may occur. In the event of accidents, the emergency response plans appear to be adequate. Evaluation of the transportation system should be continued with a view to the introduction of risk-reducing measures where the opportunity arises.

10.3.4 Management

Chem-Security took the position that it is important that one entity be responsible for all phases of the transportation system. Inspection of the system is easier, liability can be established and coordination is enhanced. To divide the operation among, say three entities, one for the consignor, one for the carrier and one for the consignee, could lead to confusion in responsibilities and compliance with the regulations. Many of the concerns of the public (i.e., liability, compensation, policing, emergency response, operating, training and procedures) as outlined in the public involvement program could then be placed at risk.

The SHERC review of the management and control of the transportation activities noted: "Against this background of total system of control exercised by Chem-Security (Alberta) Limited (CSAL), management of the existing collection, transfer and transport activities has generated few concerns. By taking a hands-on role in equipment selection and driver training, installing tachographs and province-wide cellular phones and implementing procedures which include strict limitations on driver work hours and extended vehicle maintenance, CSAL practices prevention and preparedness."

The Board agrees that the existing system, where a single entity is the operator of the transfer stations, the transportation carrier system and the Special Waste Treatment Centre, is appropriate and minimizes risks related to transportation of waste to the Treatment Centre.

10.4 Risk Assessment

The anticipated increase in special waste shipments associated with the proposed expansion of the Treatment Centre would increase the risks of hazardous material truck accidents and cargo spills, however, a major portion of the additional shipments would be bulk solids which have a lower risk factor. To address this concern, the applicant provided an assessment of the risks of special waste transport to the Treatment Centre. The purpose of risk analysis is to assess the likelihood of events of all types (usually accidents) and their probable consequences. Risk, in the technical sense, is the sum of all possible outcomes of the products of the chances of events (i.e. their expected frequencies) and of the severities of their consequences. Truck transportation hazards include vehicle accidents, which may entail casualties, cargo spills or both, and cargo spills that are not a consequence of vehicle accidents but are due to some other cause. Cargo spills, in turn, may or may not entail property and environmental damage.

10.4.1 Risk Assessment Methods and Results

Chem-Security submitted a risk assessment study. Special waste trucks from throughout Alberta converge on the Centre by one of the routes shown in Figure 10-1. As these routes carry the greatest volume of shipments, they were examined in detail, particularly Route I which is predicted to carry 72 percent of the shipments. The special waste shipments in 1989 numbered 318 (1.3 per day) and carried 5,504 tonnes. The predicted shipments, used in the risk assessment, for the expanded Centre were 2,479 per year (10 per day) carrying 60,000 tonnes.

The risk assessment concentrated on the frequency of special waste truck accidents and their associated cargo spills and casualties. The expected frequency of waste materials truck accidents was estimated from historical accident rates and anticipated truck traffic volumes. The estimate was then reduced to account for the established safety record that has been the result of the applicant's driver training, vehicle maintenance and system monitoring. Historical data was used to assess the fraction of truck accidents that would result in either a spill or a casualty.

Although cargo spills during transport (including loading and unloading) that are not associated with vehicle accidents are fifteen times as common as cargo spills associated with vehicle accidents, they were not included in the transportation risk assessment. The two-part rationale offered was that:

- spills during transport are generally small in volume and therefore pose an insignificant risk to the public and property; and

- spills during loading and unloading are confined to the generator sites, transfer stations and Treatment Centre sites and therefore pose little risk to the public.

A further limitation of the transportation risk assessment was that there was little information available on the potential consequences of vehicle accidents or spills. Although it is stated in the EIA that the method of risk analysis used in the applicant's study entailed "the evaluation of accident rates, their analysis by causal factors, and consequence analysis related to both hazardous substance and spill characteristics", the risk analysis in the application provided only a cursory discussion of event consequences.

SHERC noted that an analysis of consequences was not included in the EIA and referred to a Canadian Standards Association (CSA) document on the requirements for risk analyses which, it said, recommends at least a "semi-quantitative" consequence analysis for the assessment of risks associated with the transport of special waste. The applicant agreed that the analysis presented in the EIA neglected consequences, but indicated that work on a consequence analysis was underway.

The applicant subsequently provided a "Consequence Analysis" conforming to the CSA requirement. In it, the risks associated with worst-case transportation spills on highways and spills into rivers were investigated. The results of the consequence analysis estimated very low probabilities (7.7×10^{-7}) or 7.7 chances in 10 million, for a highway spill of individual chemicals at a specific location, and for a spill into the Athabasca River a probability of 4.7×10^{-7} which was considered extremely low by Chem-Security. With respect to the consequences of a spill into the river, the applicant said:

> "A spill of acetone or MC at Fort Assiniboine would affect aquatic life in the Athabasca River. However, the impacts would be limited to aquatic life in the immediate vicinity of the spill. In this zone, concentrations would likely be acutely toxic but, because the return to background concentrations is rapid, no lingering effects on the biota is anticipated. The effect on aquatic life at the downstream locations would be minimal because of rapid dilution and a high rate of decay."

With respect to the possibility of fatalities as a consequence of an accidental spill, Chem-Security stated:

> "The Major Industrial Accidents Coordinating Committee (MIACC) Working Group 5 considers individual fatality risks of less than 1.0×10^{-6} per year to be sufficiently low such that no land use restrictions are recommended. Since the spill probability is estimated to be less than 0.77×10^{-6} per year, it follows that individual fatality risks are less than the MIACC criterion. Thus, transportation through populated communities along the proposed transportation route would not pose an unacceptable level of risk."

The applicant indicated that the total number of special waste shipments is expected to increase from an average of 1.3 trucks per day to an average of 10 trucks per day. The projected waste truck accident frequencies are expected to increase from the current 1 in 53 years to 1 in 6 years. The projected spill frequencies are expected to increase from the current

1 in 224 years to 1 in 25 years. Roughly one-eighth of such spills would involve dangerous goods deemed to have the potential for serious consequences (Classes 3, 5, 8).

The applicant stated that it is unlikely a cargo spill would result in serious consequences to the public or to developed property because the transportation routes are sparsely populated. The majority of any accidents would occur away from populated and developed sites. The probability of a spill at a specific significant site, such as a river crossing or near a populated area was estimated to be about one in a million.

10.4.2 Views of the Board

The Board is satisfied that the probability of a serious incident involving a spill associated with a vehicle accident is acceptably low because the frequency of accident spills is expected to be low, the majority of the wastes transported are not acutely dangerous and the chances that an accident will occur at a populated site or river crossing are very low. The accident frequency studies do not represent the total frequencies for the province as they are limited to the study region, north and west of Nisku. This is, however, the region where the greatest potential impacts would be seen. The Board has taken into account in its evaluation of the information the limitation in the study area. The Board is satisfied that the transportation of the identified increased volumes of waste to the Treatment Centre would not present unacceptable risks to the public.

The assessment was largely restricted to risks to the public and private property, and excluded detailed consideration of environmental damage, except for the potential consequences of river spills in the Consequence Analysis. The Board believes that spills at river crossings represent the greatest potential threat to the environment from the transportation of special waste because the majority of spills in other locations should be relatively easily contained and cleaned up. The Board does not necessarily agree with all details of the risk assessment carried out by the applicant. Nevertheless it is prepared to accept that the applicant's assessment of the probability of a river spill is reasonable and conservative. The Board recognizes the consequences of worst-case river spills are potentially severe, but considers the probability of such an occurrence sufficiently remote as to present an acceptable risk.

11. SOCIO-ECONOMIC EFFECTS OF THE PROPOSED EXPANSION

The information concerning broader community based social and economic effects which are anticipated as a result of the proposed expansion are described in section 6 of the EIA and the response to the Board's request for supplemental information filed September 24, 1991.

11.1 Population

Chem-Security stated that historic population growth within the Town of Swan Hills has run parallel to cyclical economic activity in the oil and gas industry, resulting in a population of 2,412 in 1990. This figure is slightly below the highest recorded population of 2,497 people in 1981. The original Treatment Centre was suggested to have had little effect on the population of Swan Hills, in that "...in spite of the Treatment Centre, the population declined with the downturn of the oil and gas sector."

During construction of the proposed new incinerator, the on-site peak labour force requirement is estimated to be approximately 220 people. This peak level is expected to last for a period of approximately six months. For the remainder of the construction period construction workers will range from approximately 20 to about 200.

It is anticipated that most workers will reside in the Town of Swan Hills with only a few residents from Fort Assiniboine, Barrhead, Whitecourt, and the communities along the southshore of Slave Lake choosing to commute daily to the work site. Consequently, it is believed that construction of the Centre would result in 20 to 120 workers requiring temporary accommodation in Swan Hills.

The long-term impact of the proposed expansion is estimated to result in the creation of a maximum of 45 direct jobs, of which 25 are expected to be filled by regional residents. The new employees are expected to locate their permanent residences in the Town of Swan Hills as a result of the location of company housing and a corporate policy inducing such a practice. The applicant estimated a maximum increase in the population of the Town of 85 to 100 as a result of the ongoing operation of the expanded incinerator. Further, the applicant stated that changes in the percentage of workers hired from outside the region will alter population estimates accordingly.

The Board agrees that the population of the Town of Swan Hills is subject to the cyclical nature of the oil and gas industry. Consequently, the proposed expansion of the Treatment Centre would likely result in a stabilizing and beneficial effect on the population of the Town.

11.2 Employment

In recent years the Town of Swan Hills is recorded as having one of the lowest unemployment rates. A large percentage of the male labour force was employed (91.8 percent), whereas female participation in the labour force was approximately 54.8 percent. The applicant indicated that any significant increase in employment opportunities in the Town would require the recruitment of workers from the adjacent municipalities or outside the region, and would attract more females to the work force.

The demand for labour during the 28-month construction phase of the project is estimated at 290 person-years. The applicant estimated that approximately 170 person-years of employment opportunities would be filled by regional residents, and said that "Very few, if any, of the construction work force is expected from outside the province."

Employment is also expected to be generated indirectly through the purchase of goods and services within the region. Indirect employment of this nature is estimated by Chem-Security to be 30 person-years. Both direct and indirect employment is estimated to generate an additional 115 jobs thereby contributing to a total employment effect of 315 jobs over the 28-month construction period.

Beyond the construction phase of the project, the start-up phase and operations are estimated to require from 20 to 45 additional employees. This would bring to 140 the maximum total number of employees required to operate the Centre. Chem-Security estimated that indirect jobs resulting from the economic activity created by the new employees would be about 10, if the number of new operating jobs were the maximum, 45. The total regional employment effect was estimated to be approximately 85 permanent jobs, assuming an increased operational requirement of 45 persons.

In their submission, the Indian First Nations noted that they were not included in determining unemployment rates and the availability of the local work force for employment in either the construction or operation of the facility. "As well, CSAL (Chem-Security) does not propose any type of systematic program or incentives for the recruitment, employment and training of local Aboriginal people". Consequently, the Indian First Nations recommended that this application not be approved until Chem-Security demonstrates a commitment to ensuring any socio-economic benefits from the plant benefit both aboriginal and non-aboriginal people, in proportion to their representation in the region.

Upon questioning during the hearing, Chief Badger stated that it was his belief the Indian First Nations were not included in unemployment figures documented in the application because the applicant had failed to consult Indian First Nations representatives on this matter. Nonetheless, the documentation as presented in the application is derived from Statistics Canada unemployment data thereby reflecting the total unemployment picture for the communities cited.

Chem-Security stated that it is an equal opportunity employer and that all applicants will be given full consideration for all positions regardless of race, sex or religion: "Thus, natives, women or any other minority will be given equal opportunities for employment, with first preference to residents of Swan Hills, followed by regional residents, and then other Albertans." The applicant also stated that active steps have been taken to employ more female operations staff. In addition, the applicant is developing training programs which would allow it to employ and train those members of the labour force who may, upon application for employment, lack the required training to be employed at the Centre.

The Board is of the view that, despite the uncertainty regarding the absolute number of jobs likely to be created by the proposed expansion, significant employment effects would result from both the construction and long-term operation of an expanded Centre. The Board encourages Chem-Security to continue to upgrade its training program to allow full participation by the local and regional population, including aboriginals, in any employment opportunities resulting from an expanded Centre.

11.3 Income

The applicant presented information showing that the average family income for the Town of Swan Hills was higher than for the province as a whole. For example, in 1986 the Swan Hills average was $44,064, approximately 8 percent higher than the provincial average. These higher income levels were suggested to result from "the high level of employment in the well-paying jobs in the oil and gas industries." Other industries represented in the region include forestry, agriculture, coal, sand/gravel, and sulphur. Chem-Security said that these higher income levels are also offset by higher local prices for consumer goods and higher property and municipal taxes. It also stated that employment income comprises about 80 percent of total household income in the region. The remaining income categories include government transfers and other items such as savings and retirement income.

The applicant submitted that over the next five years, economic conditions in the Town of Swan Hills, without the proposed expansion, would be influenced largely by the oil and gas sector. Based on interviews with six major oil and gas companies, the applicant estimated that the overall employment level is expected to decline by approximately 10 percent over the next five years. Similarly, the oil field services sector and the transportation sector are expected to change in a similar direction. Given oil and gas industry expectations, Chem-Security said the overall short-term economic trend in the Town, without the proposed expansion, is expected to be toward "stabilization of activity at best."

Revenues related to the regional component of capital expenditures are estimated to be approximately $9 million, of which $7.2 million is expected to be spent on labour, wages and salaries. Approximately $600,000 in additional income is expected to be generated by the creation of new jobs in the business services sector.

In addition to the $7.2 million noted previously, the applicant stated that construction workers who commute to the project are expected to leave a portion of their income in the region in the form of local purchases such as food, temporary accommodation and gasoline. This portion was estimated to be about 15 percent of their total income or $720,000. This latter amount is assumed to become part of regional economic income thereby potentially increasing total regional income by $8.5 million. After leakage from the region in the form of taxes, government transfer payments, savings, and the purchase of goods, the applicant estimated that about $3.4 million of income would be retained in the region as a result of construction. For every dollar retained in the region it is anticipated that an additional $0.26 would be generated in non-basic sectors, adding $900,000 of income to the total generated.

During the operation of the proposed expanded Centre, new household income would accompany new employment. The applicant estimated that about $2.1 million would be generated annually in this form. Additional expenditures on local purchases of supplies and services are estimated to total about $500,000 per year. Of this amount approximately $165,000 would accrue to wages and salaries thereby resulting in a total economic effect of $2.2 million. Of the $2.2 million, approximately 40 percent, or $880,000 per year, would be retained within the region, having regard to income leakage to outside of the region. Through spending and respending, an additional $230,000 is expected to be contributed to household income. As a result the applicant estimated that the operation of the project would increase annual regional household income by approximately $1.1 million.

The Town of Swan Hills stated that the proposed expansion would be an economic benefit to the community and would provide a degree of industrial diversification for the province.

The Board is aware of the approximate nature of the economic forecasts, but concludes on the basis of the information before it, that the economic benefits to the community of Swan Hills and other communities in close proximity to the Centre would be significant.

11.4 Housing and Other Community Services

In 1988, the Town of Swan Hills had a housing stock of 915 units. Mobile homes represented the most significant type of dwellings at 370 units. Single-detached homes equalled 348 units. The remaining 197 units were a mix of row or town houses, collective dwellings, duplexes, and others. The community has a high percentage of mobile homes and a relatively low proportion of single detached homes when compared to the provincial average. The seasonal and mobile nature of the oil and gas sector was stated by the applicant as the reason for this housing mix in Swan Hills.

According to the applicant, the Town is recognized as having a low incidence of home ownership. This is influenced by the "long history of company provision of housing to their employees." The applicant and other local companies own houses and rent them to employees. Recently, some companies have begun to sell their houses to employees. As a result, the number of privately owned houses has increased.

At the time the EIA was prepared, the number of private homes listed for sale was in the 15 to 20 unit range, as compared to previous years where the range was from 7 to 9. Currently, a used, single detached, 3-bedroom bungalow is estimated to have an average value of $47,900.

The rental housing market indicates that, on average, two rental trailer units in designated residential areas have been available each month since September, 1990. Private market rents currently approximate from $550 to $650 per month for trailer units, $390 per month for a one-bedroom apartment, and $440 per month for a two or three-bedroom multiple unit.

There is presently one mobile home trailer park in Swan Hills having 86 lots and a potential to build an additional 10 lots. Currently, approximately 18 lots are vacant with the expectation that additional vacancies will become available in the near future.

In addition to the available housing stock, the Town of Swan Hills has an "ample" supply of vacant residential lots available and "extensive" lands set aside for future residential development.

In order to accommodate employees, Chem-Security stated that it currently owns 41 single-detached houses and 17 townhouses, and leases 10 trailer units. At present a number of these units are identified as unoccupied. The applicant has stated that it intends to construct five new houses, bringing the total number of company units to 73.

During the construction period, temporary accommodation requirements are expected to range from between 10 and 60 units, assuming a degree of double occupancy. The supply of temporary housing includes a mobile home park and 131 hotel or motel rooms. In the event of a shortage of temporary housing, "Town officials believe that more trailer lots can be made available...".

In-migration of an estimated 15 to 35 permanent families is expected to create a need for new housing. It is "anticipated that most of the demand could only be met by building new houses in the Town's future development zones." In addition to an expanded population base contributing to a need for additional housing, Town policy advocating the reduction of mobile housing, the increase of quality single-family units, and the provision of a variety of houses to meet varied demands, will influence the housing market.

Depending upon the rate of growth experienced by the Town of Swan Hills, the applicant's economic analysis shows that:

> "The expansion project may require the Town to expand into new areas for new housing. The cost of financing the land development and the associated infrastructure, including water and sewerage systems, will increase the debt load of the municipality. The municipality has already had an average property tax and mill rate higher than the Alberta average. Its current tax burden has also exceeded the Local Authority Board Debt

Guidelines. Additional borrowing for this project will also further hamper the municipality's flexibility in borrowing for other capital project developments."

The Board recognizes that there will be costs to the community if the proposed expansion results in considerable growth, even though oil and gas operations in the area seem to be in somewhat of a decline. However, it notes the support of the Town for the expansion and accepts that the municipality will take steps to ensure that its finances are managed in an judicious manner.

The Board has also reviewed the nature and extent of potential impacts on education, policing, hospital, health and other services, and has concluded that, given the relatively small projected increase in the population of the Town of Swan Hills, existing services are not likely to be strained or otherwise adversely affected by an expanded Treatment Centre.

12. PUBLIC INVOLVEMENT

Providing the public with information and obtaining public input into the terms of reference established for the EIA were important initial steps in the preparation of the application and for the hearing. Reviewing the process and the resulting information assisted the Board in assessing:

- the issues and concerns of the public;
- the applicants responses to those issues;
- the public acceptability of the proposed expansion; and
- the need for ongoing public involvement.

The siting of the original Treatment Centre was the result of a public consultation process to locate and select a suitable host community and a technically suitable location. This process was completed over a five-year period and included extensive public hearings throughout Alberta. The selection of the Swan Hills site was announced in 1984. After the site had been selected, the applicant continued to communicate with and involve the public through the formation of the Swan Hills Citizens Liaison Committee in 1984, the establishment of a public relations office; and since 1987, the publishing of a quarterly newsletter reporting on Alberta Special Waste Treatment Centre activities.

In addition to the above, Chem-Security stated that it had conducted special public consultation programs focusing on the proposed expansion. The following is a summary of Chem-Security's evidence in that regard:

- formation of a Public Consultation Steering Committee comprised of representatives from the Town of Swan Hills, the Swan Hills Citizens Liaison Committee, the Alberta Environmental Network, the Native Council of Canada (Alberta), the Waste Treatment Centre, ASWMC and Chem-Security. The Committee was formed to assist with the public consultation process, to identify issues, identify the public groups involved and to act in an advisory capacity;

- a multi-stakeholder consultation meeting was held on November 6, 1990, to facilitate input into the draft Terms of Reference for the EIA and discuss concerns on topics such as air quality, aquatic resources, water, health risk assessment, socio-economic factors, transportation, vegetation, soil, land and wildlife. One hundred and thirty people attended the meeting;

- a brief presentation was made by the applicant to the Alberta Community Environment Conference on December 1, 1990;

- open houses were hosted by Chem-Security at 17 communities throughout Alberta. The applicant reported that before and during the open house programs, media coverage was extensive. Notices of the meetings were advertised on radio, in

major daily and community weekly newspapers, and in environmental publications. Approximately 54 news articles were published in newspapers throughout Alberta. Direct telephone calls were made to many agencies in each of the 17 communities;

- the draft EIA was placed in 17 libraries in the vicinities of the meetings to facilitate easy access to information by local residents;

- special editions of the newsletter "Site Line" (circulation 15,000) and "In our Back Yard" (circulation to approximately one million households in Alberta) which dealt with the expansion proposal were published by ASWMC; and

- the citizens of Swan Hills were extensively involved in the planning for the proposed expansion. This included participation in meetings with the Liaison Committee and Town Council and involvement with the steering committee, open houses, and the public relations office.

Although the applicant expressed disappointment at the lack of attendance at the meetings, it acknowledged that it received constructive input. Chem-Security concluded that public support for the proposed expansion was favourable. During the hearing, the applicant confirmed that an ongoing public involvement process was important and that it would be continued into the future.

Chem-Security indicated that it was directly assisted in the public consultation program by the ASWMC which conducted a public awareness program relating to the broader issue of special waste management in the province.

The applicant advised that aboriginal consultations, facilitated by the Native Council of Canada (Alberta), were initially conducted in February, 1991 and consisted of meetings in Swan Hills, Slave Lake, Desmarais and Grouard. According to Chem-Security, over 80 aboriginal people from some 10 Indian Bands and other native communities attended the meetings. In addition to the above, advertisements were placed in local newspapers, radio advertisements were aired on the "Native Perspective" morning show, invitation letters were distributed, posters were hung and telephone contacts were made.

The effectiveness of this consultation process with native groups by the applicant and the notices published by the NRCB was questioned by the Indian First Nations. As indicated in section 1 of this report, the Board concluded that the efforts to inform the Indian First Nations had not been effective, particularly at the local level, and therefore the Indian First Nations were not in a position to participate in the hearing. This led to the adjournments referred to in section 1.

The Board concludes that the applicant has conducted an extensive public consultation process, and accepts the applicant's evidence that it has been responsive and sensitive to many of the concerns brought to its attention through the public consultation process.

Considering the commitments made at the hearing and the applicant's past activities in this regard, the Board believes the applicant would continue to facilitate public involvement with respect to the proposed expanded Centre. The Board, in particular, notes the good relationship between the applicant and the Town of Swan Hills and encourages the continuation of public involvement programs such as those undertaken in the past, to enhance and strengthen this relationship. The Board also recommends that efforts be made to ensure that all interested members of the public have an opportunity to appropriately participate in the ongoing public involvement programs.

13. OTHER MATTERS

13.1 Other Environmental Effects

Possible environmental effects of the treatment and disposal of solid and liquid wastes at the Treatment Centre are dealt with in sections 7, 8 and 9 of this report. Effects of the transportation of waste to the Centre are dealt with in section 10 and conflicts with other land use in section 13.4. The existence of the proposed expansion would not materially alter the effect of the Treatment Centre on other land use because it would not involve enlargement of the site. For the same reason, its existence would not occasion environmental effects other than those resulting from its operation and dealt with in sections 7, 8, 9 and 10. There remain to be reviewed some minor potential effects of the construction, as opposed to the operation, of the expansion.

Chem-Security stated that there may be some increased movement of sediment into surface waters from areas disturbed during construction, but that this is likely to be minimal because of the collection of surface runoff on the plant site into the retention ponds. Additional cells would be constructed in the landfill area to accept greater volumes of solid waste from the proposed expansion. This area does not drain into the retention ponds, but to a point in the east-central part of the landfill. The potential for runoff carrying an additional sediment load from this area to streams off the Treatment Centre site is small. Any areas disturbed by construction would be revegetated, so that no long-term increase in sediment input to streams would be likely. Chem-Security suggested that there would be no significant impact on aquatic resources as a result of the possible short-term and minor increase in sediment loads. Chem-Security also stated that preparation of the site for construction of the proposed new kiln might cause small local changes in relief and, consequently, in the elevation of the shallow groundwater table. It did not consider that these would be significant.

Construction could also affect soils and vegetation. Chem-Security stated that construction of landfill cells, roads, parking areas, and utility systems as well as of the incinerator itself could disturb soils. Vegetation could be affected if drainage patterns are altered and through revegetation of disturbed areas. The applicant intends to mitigate these effects by limiting the area disturbed, minimizing cuts and fills, salvaging materials for reclamation, employing drainage and erosion control measures to stabilize surfaces and restore natural drainage patterns, and revegetating the disturbed area.

According to Chem-Security, the proposed expansion of the Centre would not result in any loss or alteration of wildlife habitat. Although construction activities, including the movement of workers and equipment, would be restricted to the area within the perimeter fence, noise and movement on-site might result in additional disturbance of wildlife. Chem-Security does not believe that this short-term impact would be significant. It suggests that sensitive wildlife species such as moose and deer might withdraw from the immediate area during construction but that they would adapt to the long-term operation of the expanded Treatment Centre. Additional traffic on the main access road during construction would also result in a

minor increase in disturbance and would increase the potential for road kills. Increased traffic during the operation of the expanded Treatment Centre would have similar, but lesser, effects. Transportation risks are dealt with in section 10.4 of this report.

SHERC and the Alberta Trappers Association both put before the Board opinion regarding the generation of dust on the site of the Treatment Centre and on roads in the vicinity of the Centre. This included dust generated during construction. Both interveners were concerned particularly that the suspension of dust in the air and its subsequent dispersion would redistribute contaminants deposited near the Centre. The Board concluded in section 7.1.7.3 of this report that resuspension of dust would not be a cause for concern.

The Board has reviewed all the evidence placed before it with respect to the potential environmental effects of the proposed expansion that are additional to the effects of its operation dealt with in sections 7, 8, 9 and 10. The Board is satisfied that Chem-Security's assessment of these potential effects as being of negligible significance is fully justified. The Board further concludes that no action is necessary beyond that proposed by Chem-Security to limit or mitigate these effects.

13.2 Plans for Emergency Response at the Treatment Centre

Section 10.3.3 deals with plans to respond to emergencies related to the transportation of waste to the Centre. With respect to the Centre itself, Chem-Security stated that it goes to great lengths to avoid emergency incidents. This begins with engineering design and includes such matters as screening incoming waste to ensure safe handling and safety features to protect against power failures or equipment malfunctions. These efforts would continue with respect to the proposed expanded Centre.

It was acknowledged by Chem-Security that notwithstanding efforts to avoid emergency incidents, they will occur. Accordingly, an Emergency Response Contingency Plan has been developed which clearly describes procedures to be followed in the event of an emergency. One of the three emergency response teams is located in Swan Hills, to facilitate quick responses to emergencies at the Centre. Chem-Security is also an active participant in the Local Oil Spill Cooperative.

Chem-Security indicated that its employees are extensively trained to deal with emergencies through regular training sessions that emphasize winter situations. Although it does not simulate incidents on-site for training purposes, members of its emergency response teams attend courses in Eastern Canada and the U.S.A. where simulations of emergencies do occur.

The applicant advised that the contingency plan is designed to provide for the safety of its employees and the public, minimize damage to the environment, ensure physical security of the plant facilities, and provide for effective reporting and communications. The plan is intended to deal with on-site incidents such as fires, explosions or spills; and off-site incidents such as forest fires, which could threaten the Treatment Centre.

Chem-Security advised that the emergency response plan has been activated on one occasion. In March 1988, there was an off-site release of liquids from a bulk tanker. The plan worked well and the experience was useful in terms of training personnel and evaluating and improving the plan. One such improvement involved the addition of one person to the emergency response team to deal specifically with coordination amongst involved individuals and organizations, and communication with the media and public.

Most of the interveners indicated a concern, either directly or by inference, that emergency situations be properly handled at the proposed expanded Centre and throughout the Waste Management System, but none challenged the adequacy of the proposed contingency plan. The Board accepts that an appropriate plan is in place, and urges the operator to continue staff training and drills with respect to the plan.

13.3 Plans For Closure of the Treatment Centre

The matter of ongoing monitoring of landfill cells is dealt with in section 8 of this report. With respect to the eventual closure of the remainder of the Special Waste Treatment Centre, the applicant indicated that prior to closing, all wastes in storage would be properly treated. All equipment and structures would be decontaminated and removed and the existing fencing, gates and signage would be left in place. The deep disposal well would be properly abandoned. Haul and other gravel roads, aside from those to the landfill area, would be reclaimed. Chem-Security stated that the site of the Treatment Centre, other than the landfill area, would then be available for other use.

A number of interveners were concerned with the ultimate closure of the Centre, and particularly the long-term security of the landfill cells. The interveners were generally concerned about the ultimate cost of ensuring that the area is properly cleaned up and who would be responsible for the cleanup. The Indian First Nations were particularly concerned that the Centre not affect their use of the region, pointing out that they have been there a long time and will be there long after the Centre is gone.

The Board expects that closure of the Treatment Centre will be many years into the future. Notwithstanding, it believes that recognition of the eventual closure should be part of the ongoing design and operation of the Centre. An important component of the eventual cleanup is the ongoing operation of the facility in a manner which minimizes the likelihood of serious contamination. This involves activities which would, for example, minimize spills and ensure prompt and thorough cleanup should they occur. This also requires accurate monitoring of ground and surface water, soil and other resources, so that any contamination that may occur is detected as early as possible. Immediate cleanup should then be undertaken, as well as actions to assess and correct the source of the contamination in the particular case.

The Board is satisfied that Chem-Security is aware of the need for and is capable of, operating the Treatment Centre in a responsible manner that will allow for the eventual successful cleanup of the site. It is also satisfied that the owners of the facility, Bovar and

ASWMC, will have the necessary resources to ensure that the cleanup is completed and the Centre is closed in a responsible manner. This will include properly abandoning any deep disposal wells in accordance with the requirements of the ERCB. The Board understands that those requirements will involve permanently sealing off deep zones into which liquid wastes have been injected and ensuring they do not flow into shallower zones.

The Board recommends that Alberta Environment, as regulator of the Centre, require the exercise of appropriate care in operations, adequate monitoring, and sufficient reporting to ensure that the eventual proper cleanup of the site will not be a technically difficult nor excessively costly operation.

13.4 Conflicts with Present Land Use

Conflicts with present land use are of interest to the Board as, depending on their magnitude, such conflicts may limit the ability of Albertans to carry on commercial or recreational activities. The information before the Board indicates that the absence of identified land use conflicts was a factor in the original site selection of the Alberta Special Waste Treatment Centre. Land use issues relating to the proposed expansion were not considered to be contentious in either the written submissions received by the Board or evidence presented at the hearing.

The Centre is located approximately 12 km northeast of the Town of Swan Hills on 130 ha of land owned by the ASWMC. This land is surrounded by a 0.8 km development exclusion zone. In addition, a "No Shooting Zone" of a 3 km radius is in place around the Centre to protect the workers at the facility.

The land adjacent to the Centre is owned by the Crown. The uses identified for the adjacent land are forest production, wildlife habitat and hydrocarbon production. With the exception of hydrocarbon production, which is faced with declining reserves in the area, these activities are seen as the most likely land uses for the surrounding area in the long term.

Local environmental and physical site features are typified by low soil fertility, stoniness, adverse topography, lack of wetlands and cool climate. These factors limit the potential for the growth of commercial forests and agricultural pursuits and provide low capability for wildlife. Designated "Natural Areas" or "Environmentally Significant Areas" are not present in the vicinity. The Board considers that the impact of the Centre on those areas identified as "Key Wildlife Areas" are not significant given their distance from the Centre. There is little agricultural land use near the Centre.

The Indian First Nations indicated that the forested region is used for Indian First Nation's activities, including the gathering of traditional herbs and medicines. In the immediate Centre area there have been no substantiated records of rare, threatened or endangered flora or fauna, and no historical or paleontological sites have been identified. There was no evidence presented by the Indian First Nations which would indicate that their traditional activities would

be impaired by the expansion of the existing Centre. Additionally, the analysis of the evidence referred to in section 7 of this reports leads the Board to conclude that such traditional activities would not be affected by the proposed expansion.

The evidence before the Board indicates that the initial construction resulted in the loss of 44 ha of forest land. Given the nature of the facility and the need to monitor the site over a period extending beyond the life of the Centre, the present land use should be considered as permanent, with or without the proposed expansion. At the time of the initial construction of the Centre, 130 ha of land was removed from a registered trap line and a small area of land was lost to hydrocarbon production. This area was considered to have low hydrocarbon production potential.

The siting of the incinerator as an expansion of the existing Treatment Centre creates fewer land use conflicts than would occur if the incinerator was constructed at a new site. The expansion will not require any further clearing of the forest. Opportunities for hunting, fishing, camping and other outdoor recreational activities have been enhanced as a result of improved access to this area. It is not expected that the proposed expansion of the Centre would result in any change to the current condition.

The Board is satisfied that the issue of present and future land use conflicts related to the proposed expansion of the Treatment Centre has been adequately addressed and is of the opinion that the effect of the expansion on existing land use would not be significant.

14. OVERALL CONCLUSIONS AND DECISION RESPECTING THE APPLICATION

The conclusions and decision set out in this section of the report result from a consideration of all of the information placed before the Board. Sections 5 to 13 deal with specific issues in detail. This section combines the conclusions from those sections and provides the Board's overall conclusions and decision with respect to Chem-Security's application to expand the Swan Hills Special Waste Treatment Centre.

The Board concludes that there are substantial volumes of special waste currently being produced in Alberta that require treatment and are likely to be sent to the Treatment Centre. As well, large volumes of such wastes which have been produced in past, have been stored or abandoned at locations throughout the province and require treatment. A facility large enough to treat these wastes is needed and would be beneficial to the people of Alberta and the environment.

Notwithstanding uncertainties respecting the exact amount of waste which requires treatment, the Board is satisfied that the volumes of waste available justify the expansion of the Centre by 40,000 tonnes per year in rated capacity as proposed by Chem-Security. In the Board's view, such an expansion should not impede programs to minimize waste production, nor should it be a significant factor with respect to any possible future change to existing Government policy regarding the importation of special wastes from out of province. The Board has made recommendations that would help ensure this is the case. (These matters are addressed in detail in section 5).

The Board is satisfied that thermal treatment by rotary kiln incineration is the appropriate technology to be used in the proposed expansion, particularly having in mind that it is a proven technology that is being utilized at the existing Treatment Centre. Chem-Security is fully qualified to construct and operate the expanded Centre. Further, the Board concludes that there is considerable likelihood that the expansion would treat sufficient volumes of waste to be economically viable on a stand-alone basis. For that reason, and recognizing that the policy of the Alberta Government is to provide proper safe treatment for special waste, even though it may not be profitable to do so, the Board concludes that the proposed expansion can be financed in the manner described by the applicant. (These matters are addressed in detail in section 6).

The Board's assessment of the atmospheric emissions from the proposed expansion of the Treatment Centre leads it to conclude that Chem-Security has selected appropriate pollution control equipment and has carried out sufficient monitoring and studies to have a good understanding and control of the types and amounts of contaminants that would be emitted. Monitoring results associated with the existing Centre and modelling studies also provide sufficient data to predict, with reasonable confidence, the level of environmental contaminants that may be expected.

On the basis of a detailed review of those predicted levels, the monitored existing levels and their effects, standards for various contaminants, and all other relevant factors, the Board

concludes that the emissions from the proposed expanded Treatment Centre would not create unacceptable risks to the health of humans or the environment. The Board also concludes that the environmental effects related to the actual construction of the expansion would not be significant.

The EIA in the application and the Board's conclusions are based, in part, on the assumptions that the expanded Centre would incinerate waste material within the same range of composition as that being incinerated at the existing Centre, would not incinerate material from wood preserving plants that is contaminated by PCPs, and would not incinerate waste containing PCBs in volumes or concentrations similar to those encountered at the Centre in previous years. Any approval issued by the Board would include conditions specifying that if at any time in future, wastes delivered to the Centre are not consistent with these assumptions, additional test burns and assessment of possible emissions and their effects would have to be conducted to the satisfaction of Alberta Environment.

The conclusions are also based on the projected performance of the proposed incinerator expansion without a heat recovery system. Such an auxiliary system would not be allowed in future unless Alberta Environment was satisfied that the Centre could continue to meet licensed emission limits.

The Board's conclusion that emissions would not represent unacceptable risks to the public or the environment is also dependent on the existence of a comprehensive monitoring program and the initiation of immediate effective action if monitoring results suggest problems may be developing. Such an approach has worked effectively at the existing Centre with respect to early identification of possible PCB contamination. Corrective actions which the Board believes should result in much reduced and acceptable levels of this particular contaminant, are now underway

In the event the expansion proceeds, the Board has made a number of recommendations, primarily to Alberta Environment, to assist in ensuring that effects on human health or the environment would not be unacceptable. Included are recommendations related to sampling of wastes delivered to the Centre; possible problems respecting the incineration of material containing heavy metals, and the formation of dioxins, furans and organometallic compounds; causes of process excursions and emergency venting, and the possibility of pollution control measures to reduce gases vented during such episodes; review and use of dispersion models; dust control measures; and review of operating and monitoring data with public health and occupational health and safety officials. The Board has also included recommendations regarding numerous issues related to operations and monitoring that should be examined during periodic reviews of any operating licences that might be issued by Alberta Environment.

(The matters of atmospheric emissions and possible effects on human health or the environment are addressed in sections 7 and 13.1.)

The expanded Treatment Centre would use secured landfill cells to dispose of the solid waste resulting from the treatment process. The testing and treatment of the waste prior to disposal, the design and planned operation of the landfill cells, and the location of the Centre in a relatively remote location characterized by impervious clay soils, cause the Board to conclude that the disposal of solid waste would create little if any environmental problems or risks to human health. The Board has included recommendations that would assist with respect to long-term security of the landfill cells and eventual closure of the Centre. (These matters are addressed in detail in sections 8 and 13.3.)

The expansion of the Treatment Centre would not contribute additional liquid wastes from the treatment process which would require deep well disposal, but some supplementary liquids requiring disposal, such as surface run-off, might increase. The Board concludes that these could be accommodated in the existing deep well disposal system without threat to the environment. With respect to accidental spills, the Board is satisfied with the applicant's plans to minimize occurrences and to react effectively should they occur. (These matters are addressed in detail in section 9.)

Spills or accidental releases related to the transportation of wastes to the Treatment Centre were also reviewed in detail. The Board concludes that the applicant's plans respecting the trucks and equipment to be used, transportation routes, allowable hours and weather conditions for transport, and the training of drivers, would minimize accidents and possible spills or releases and the related risks to the public or environment. The emergency response plan of the applicant is such that significant lasting effects as a result of accidents in transportation or at the Centre should be minimal. (These matters are addressed in detail in sections 10 and 13.2.)

The social and economic effects of the proposed expansion would be predominantly felt by the Town of Swan Hills and the surrounding region. The Board concludes that although the economic effects would not be great, they would be beneficial to the Town and region at a time when resource extraction operations are in some decline. Any adverse social effects would be incrementally small and the Town appears well prepared to deal with them. Ongoing efforts would be needed to allow full participation in employment opportunities by the local and regional population, including aboriginals. (These matters are addressed in detail in section 11.)

The Board concludes that there is little conflict between the proposed expansion and existing or expected future land uses. It also concludes that Chem-Security has had an extensive public involvement program in the past and will continue it in future. In this regard, the Board believes the Indian First Nations living south of Lesser Slave Lake should have a more significant role. (These matters are addressed in detail in sections 7, 12 and 13.4.)

In summary, the Board concludes that it is in the public interest to have adequate capacity available to safely treat special wastes rather than having them stored throughout the province. The size of the proposed expansion appears appropriate for the anticipated volumes of waste, and the expansion would have a beneficial economic impact on the Town of Swan Hills and the

region. Any adverse social effects would not be substantial. There would be adverse effects on the natural environment, but the design of the Centre and plans for monitoring and mitigation are such that the environmental effects should not be unacceptable, provided the conditions that would be attached to a Board approval, and all applicable regulations, standards and requirements of the Province, including the recommendations of the Board, are observed. The Board therefore concludes that the proposed expansion of the Centre is in the public interest.

The Board is prepared to approve the application of Chem-Security (Alberta) Ltd. for the incinerator expansion at the Alberta Special Waste Treatment Centre, subject to certain conditions and to receipt of the necessary authorization from the Lieutenant Governor in Council. The approval would be in the form shown in Appendix E.

In addition to those conditions contained in the draft approval, the Board expects that Chem-Security, as applicant and operator of the Centre, will discharge all of the commitments and undertakings given in the application and at the hearing. The Board has also included in its assessment and conclusions a number of recommendations regarding ongoing operation of the expanded Treatment Centre. Alberta Environment would be responsible for regulation of those operations. For the convenience of Alberta Environment, Chem-Security, and other interested parties, Appendix F contains a summary listing of the Board's recommendations.

DATED at Calgary, Alberta on April 30, 1992.

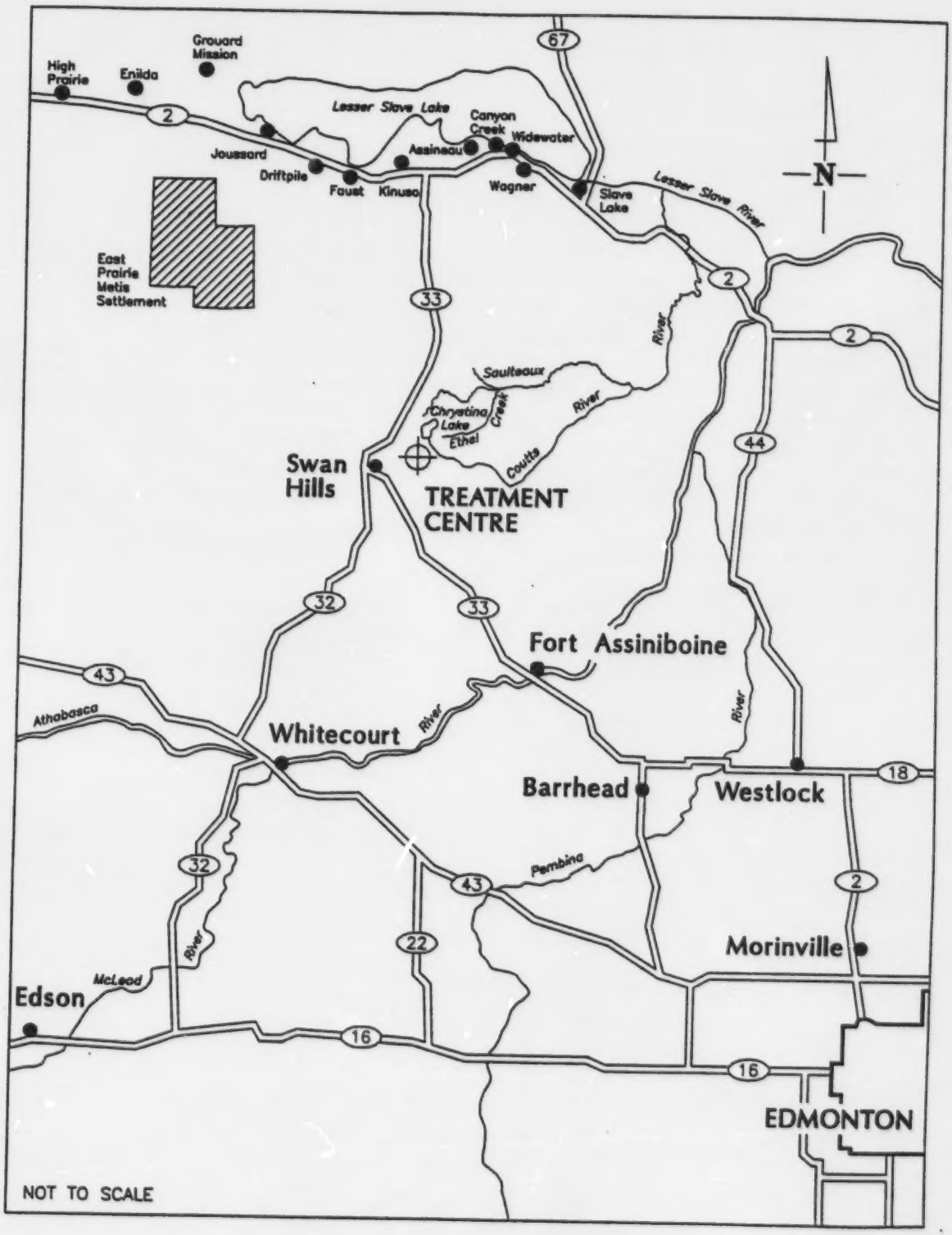
NATURAL RESOURCES CONSERVATION BOARD

G. J. DeSorcy
Chairman

G. A. Yarranton
Vice Chairman

C. H. Weir
Board Member

APPENDIX A - Map - Location of the Treatment Centre



Alberta
ORDER IN COUNCIL

APPENDIX B - Copy of Order in Council

APPROVED AND ORDERED,

Gordon Towers

LIEUTENANT GOVERNOR

O.C. 377/91

June 6, 1991

EDMONTON, ALBERTA

Upon the recommendation of the Honourable the Minister of the Environment, the Lieutenant Governor in Council, pursuant to section 4(f) of the Natural Resources Conservation Board Act, prescribes the incinerator expansion at the Alberta Special Waste Treatment Centre at Swan Hills proposed by Chem-Security (Alberta) Ltd. as a reviewable project under section 4(f) of the Natural Resources Conservation Board Act.

Don R. Getty

CHAIRMAN

Certified a True Copy

Clerk of the Executive Council

NATURAL RESOURCES CONSERVATION BOARD
Calgary, Alberta

SWAN HILLS WASTE TREATMENT CENTRE IN THE SWAN HILLS AREA — Report of Public Meeting Held - 3 July 1991 Respecting Proposed Expansion

1. INTRODUCTION

The Natural Resources Conservation Board Act (the Act) created a Board "...to provide for an impartial process to review projects that will or may affect the natural resources of Alberta in order to determine whether, in the Board's opinion, the projects are in the public interest, having regard to the social and economic effects of the projects and the effect of the projects on the environment." The Act spells out certain types of projects that are subject to review. These "reviewable projects" include any specific project prescribed by the Lieutenant Governor in Council. The Act prohibits the commencement of a reviewable project unless the Natural Resources Conservation Board (NRCB), on application, has granted an approval of the project.

The Lieutenant Governor in Council, by Order in Council 377/91 dated 6 June 1991, prescribed "...the incinerator expansion at the Alberta Special Waste Treatment Centre at Swan Hills proposed by Chem-Security (Alberta) Ltd. as a reviewable project under ..." the Act. As a result, Chem-Security (Alberta) Ltd. (hereinafter referred to as Chem-Security) will be required to file an application with the NRCB and obtain an approval prior to commencing the planned expansion.

The Board held a public meeting at the Swan Hills Community Centre on 3 July 1991 to hear representations regarding a number of aspects of the proceeding to be used to consider the expected application. Those individuals or organizations that attended and participated in the meeting are listed in Appendix A.

This report presents the Board's conclusions respecting the matters considered at the meeting. It does not include a detailed summary of the various views presented by participants in the meeting, but a transcript of the meeting is available for review at the Board's offices. The agenda items for the 3 July meeting were as follows:

1. The information to be included in an application.
2. The likely timing of the filing of an application.
3. The need for a hearing and pre-hearing meetings.

4. The timing and location of the hearing, if one is required, and the dates for the filing of submissions.

5. Intervener funding.

6. Other matters.

2. BACKGROUND REGARDING THE PREPARATION OF THE ENVIRONMENTAL IMPACT ASSESSMENT

Alberta Environment advised the Board at the outset of the meeting that the Environmental Impact Assessment (EIA) process had commenced in mid-1990. Draft terms of reference for the EIA were prepared in late 1990, reviewed by Government departments, and circulated for comment to certain special interest environmental groups. The terms of reference were finalized in early 1991 and Chem-Security commenced preparation of the EIA. The draft EIA was initially prepared in draft form and made available to the public at a number of meetings.

Alberta Environment advised that Chem-Security had completed the EIA and filed it with Alberta Environment on 2 July 1991. Alberta Environment and some 15 other government departments will now commence the review of the EIA and expect to identify any information deficiencies by the end of August.

3. THE INFORMATION TO BE INCLUDED IN AN APPLICATION

The NRCB, by letter dated 7 June 1991, advised Chem-Security of the information that would be required in an application to expand the Swan Hills Waste Treatment Centre. The required information includes the EIA referred to in the previous section of this report. The Board's letter to Chem-Security was made public, and in particular, participants in the 3 July meeting were aware of its contents.

Chem-Security stated that it was preparing an application in accordance with the 7 June letter from the NRCB and expects to file the application, including the EIA, by the middle of July.

Participants in the meeting were generally of the view that the requirements set out in the 7 June letter were comprehensive, but a number of them raised issues which they said were either absent from the letter or were worthy of special emphasis.

Several of the participants commented on the need for the application to deal with matters

such as:

- o the commercial viability and economics of the project,
- o the financing arrangements,
- o the economic impacts,
- o the need for the expansion,
- o the types of wastes to be handled and their origins,
- o the required provincial infra-structure including transportation routes,
- o the security of pit liners and other safety measures, and
- o the plans to respond to possible emergencies.

The Board agrees that these are issues that can affect the overall public interest of the proposed expansion, and has included a requirement for information to deal with them. It notes that the terms of reference for the EIA also deal with a number of these matters. The Board however, wishes to emphasize that it has jurisdiction, through the prescribing Order in Council, to deal only with the expansion of the project. As a result, information respecting the existing facility will be required only to the extent that it is needed to assess the affects of the proposed expansion.

At least one of the participants raised the question of whether the Board would be dealing with the issue of bringing wastes to the proposed facility from outside the province of Alberta. The Board has asked the applicant to provide information respecting the origins of the wastes it intends to treat. The information supplied in that regard will largely determine whether wastes from extra-provincial sources are relevant to the application before the Board.

The questions of alternatives to the use of incineration in general and of alternatives to the expansion of the incineration facilities at the waste treatment centre in particular, were also raised as issues to be dealt with at the hearing. The Board believes the question of alternatives to the proposed expansion is a matter which will likely be discussed at any hearing, but emphasizes that its interests would relate only to alternatives to the expansion and not to alternatives for the facilities which were built several years ago and are in operation. The Board would expect to review the alternatives to the expansion on the basis of economic, technical and other information relating to the need and justification for the proposed expansion.

Participants in the meeting also suggested a number of broader issues that should be considered by the Board. These included matters such as provincial policies regarding wastes, the handling of toxic wastes in the past, the question of whether industry has sufficiently reduced

the generation of wastes, and the potential problem of poor communities becoming areas for the dumping of wastes. The Board does not consider that it has jurisdiction with regard to such matters and would not require information respecting them.

Some participants suggested that the review should be considering cumulative impacts of not only the Swan Hills Special Waste Treatment Centre, but also of logging, petroleum and other activities that might affect the area or the Athabasca River. The Board does not intend a detailed review of the impact of other facilities or activities in the region, but it does intend to take into account in its assessment the extent to which the effects of the proposed expansion add to or compound the effects of existing development in the affected area. To that extent, the assessment will be "cumulative" in nature, and the Board will expect the information to be provided in accordance with part 20 (a) of its 7 June letter to be sufficient to allow such an assessment.

The question of federal involvement in the review of the expansion application was also raised. The Board has been in contact with federal officials in this respect and has been advised by Environment Canada that "...Environment Canada will not be initiating the Environmental Assessment and Review Process (EARP) with regard to this project. I am also not aware of any other federal government department having, or intending to do so." The Board also knows that Federal officials have been kept aware of procedures regarding the preparation of the EIA, and that they will have an opportunity to review the EIA and provide input to Alberta Environment with respect to any deficiencies. They will also be provided with a copy of the application to the NRCB when it is filed.

In summary regarding the information to be included in an application, the Board is satisfied that the requirements set out in its 7 June 1991 letter to Chem-Security, coupled with the Terms of Reference for the EIA, are such that sufficient information should be available to assess whether or not the proposed expansion is in the public interest. Upon receipt of the application, the Board will review it in detail for deficiencies and request any additional required information from Chem-Security. In making the review, the Board will have appropriate regard for those matters discussed at the Swan Hills meeting.

4. THE LIKELY TIMING OF THE FILING OF AN APPLICATION

As indicated earlier in this report, Chem-Security advised the Board that it has already filed the EIA with Alberta Environment and plans to file an application with the NRCB by mid-July. The Board does not believe its conclusions in the previous section regarding the information to be included in an application should significantly affect the filing date.

Following receipt of the application, the Board will review it for completeness. Provided the application is filed by mid-July, the Board expects that the review will be completed by the end of August, the time at which the Alberta Environment co-ordinated review of the EIA is

intended to be completed. A letter outlining any deficiencies in the application, including the EIA, will be sent to Chem-Security.

5. THE NEED FOR A HEARING

Chem-Security took no position on the need for a public hearing to review its expansion application, but described the EIA preparation and review process to date. The Mayor of Swan Hills and the Swan Hills Liaison Committee questioned the need for a hearing, recognizing the extensive review of the Swan Hills facilities over the past 10 or so years. Most other participants took the position that there was a need for a hearing, referring to many potential impacts the planned expansion could have on the province.

The Board believes sufficient interest and concerns exist respecting the proposed expansion to justify the holding of a public hearing.

6 THE TIMING AND LOCATION OF THE HEARING

Chem-Security suggested that the preparation for the hearing could commence with the filing of its application in mid-July, and proceed in parallel with the deficiency review process. It therefore contended that any hearing should be held not later than early November 1991. Chem-Security suggested that any hearing should take place in Swan Hills.

The Mayor of Swan Hills and the Liaison Committee both stated that if a hearing is judged to be necessary, it should be in Swan Hills and should take place as soon as possible.

Several of the other participants took the position that the hearing should not occur until three to four months after the application was complete. They suggested that this would mean a hearing in the spring of 1992. None opposed a hearing at Swan Hills, but several suggested that a hearing should also take place at Edmonton and perhaps other locations in Alberta. Mr. Lawrence suggested the need for additional pre-hearing meetings at major centres in Alberta to further scope the EIA and the contents of the application.

With respect-to the location of the hearing, the Board believes as a principle, that hearings should generally take place in the regions in which projects are proposed. In this manner, those persons most directly affected by a project would have the maximum opportunity to participate in the hearing respecting that project. In this case, the Board believes the hearing should be in Swan Hills.

The Board does not believe there should be more than one hearing of a project, as was

suggested by some participants, except in very special circumstances. This is because each of the hearings would have to be complete in all respects, in order for participants to follow the proceeding and have meaningful input. This would not be efficient, and in the Board's judgement, is not warranted with respect to the expansion of the Swan Hills Special Waste Treatment Centre. Also, although the Board is very supportive of ongoing discussions between the applicant and potential interveners, it does not believe further formal pre-hearing meetings are needed at this time.

The Board believes the timing for the hearing should be based on the expectation that the application will be filed by mid-July and that the deficiency review for the application, including the EIA, will be available by the end of August. The Board also believes that the timing should recognize that the preparation of the EIA has included a public involvement process, the EIA is now available to the public, the application itself will be available by mid-July, and the preparation for the hearing can be going forward while the deficiency review is taking place. Having those factors in mind, the Board does not accept the position of some of the participants that three to four months are required after the response to deficiencies is complete. Rather, it believes that approximately six weeks would be adequate notice following the receipt of the response to deficiencies. This compares to the minimum of 30 days notice as provided by the Act and draft regulations.

The Board believes the following schedule is a reasonable one in terms of the timing of the hearing.

Availability of EIA	- 2 July 1991
Filing of application	- 15 July 1991
Completion of review and request for deficient material (application and EIA)	- 30 August 1991
Response to deficiency request	- 23 September 1991
Hearing date	- 12 November 1991

On the basis of the above schedule, the Board will set the hearing for the Swan Hills Community Centre commencing 12 November 1991. If some of the critical dates in the above schedule are substantially delayed, for example the response to the deficiency letter, the Board would reconsider the date for the hearing.

The Board will be issuing a preliminary notice of the application after it is filed in mid-July, and announce the planned hearing date of 12 November 1991. Following the filing of a satisfactory response to any deficiency letter, the Board will be issuing a final notice of hearing, confirming the 12 November hearing date or establishing a new one if there has been significant

slippage to the schedule.

There was little discussion of the appropriate date for the filing of submissions. The Board believes that with a planned hearing date of 12 November, a filing date for submissions of 1 November 1991 would be appropriate.

7. INTERVENER FUNDING

The Board is authorized by the Act to award costs to "Individuals or groups of individuals who, in the opinion of the Board, are or may be directly affected by a reviewable project...". Much of the discussion respecting this matter related to the interpretation of the words "directly affected". The Board has drafted intervener cost regulations which it considers consistent with the direction given by the Act. Those regulations have been released in draft form for comments from the public and should be finalized by about 22 July 1991. The Board will shortly thereafter issue a guideline document which will give greater details regarding intervener costs. Participants in the Swan Hills meeting will be provided with copies of the finalized regulations and the cost guidelines as soon as they are available.

Many of the participants in the meeting indicated a desire to work together to ensure a co-ordinated approach by interveners at the hearing and thus make the proceeding more efficient. They also expressed a desire to work with the applicant, Chem-Security, to identify and possibly resolve questions and concerns prior to the hearing. Chem-Security expressed support for such an approach, and a meeting between a number of environmental groups and Chem-Security is scheduled for 15 July 1991.

The Board is highly supportive of efforts by interested parties to work together and make the hearing process more efficient, and hopefully more effective. It also strongly supports early and on-going communication between potential interveners and the applicant, with the objective of identifying and possibly resolving concerns.

The Act and regulations have as their basis, the awarding of costs after a proceeding has been completed. They do however, provide for an advance of costs where judged appropriate. Any potential intervener, either prior to or following the 15 July or similar meetings with the applicant, may wish to make application to the Board for recognition as a directly affected party and for an advance of costs. Such requests must be in accordance with the regulations and guidelines, and in particular should include reasons why the intervener considers itself a directly affected party. The request should also detail the studies that would be undertaken, the type of expert assistance required, the estimated costs, and reasons why an advance is necessary. The Board would obtain comments on such requests for advance funding from the applicant and make the necessary decisions regarding the eligibility for costs and the need for an advance.

8. OTHER MATTERS

A number of additional matters were raised at the meeting, a few of which warrant Board comment in this report. There was a suggestion at that meeting that the expansion of the Swan Hills Special Waste Treatment Centre has commenced. The Board has investigated the matter and determined that such is not the case. The Act and prescribing Order in Council prohibit the commencement of the expansion of the Centre until the necessary NRCB approval is obtained. The Board is satisfied that Chem-Security is fully aware of that requirement and will adhere to it.

One other matter related to the need for an NRCB Edmonton office as well as that located in Calgary. The Board has made arrangements for a small Edmonton office and the address of that office and the one in Calgary are as follows:

Calgary Office:

10th Floor Energy Resources Building
640 - 5th Avenue S.W.
Calgary, Alberta
T2P 3G4

Telephone: (403) 297-8303
FAXS: (403) 297-5270

Edmonton Office:

7th Floor Princeton Place
10339 - 124 Street
Edmonton, Alberta
T5N 3W1

Telephone: not available at this time
FAXS: not available at this time

It is anticipated that the Edmonton office will open on or shortly after 22 July 1991. Interested parties may contact either office in order to arrange for an appointment to review documents maintained with respect to this proceeding.

DATED at Calgary, Alberta this 11th day of July 1991.

NATURAL RESOURCES CONSERVATION BOARD

G. J. DeSorcy
Chairman

G. A. Yarranton
Vice Chairman

C. Weir
Board Member

APPENDIX A

THOSE WHO APPEARED AT THE 3 JULY 1991 MEETING AT SWAN HILLS

Participants

Chem-Security (Alberta) Ltd.
F. M. Saville, Q.C.
R. A. Neufeld

Alberta Environment
R. L. Stone

Alberta Trappers Association
J. Rogers

Eco-City Society of Edmonton
Edmonton Friends of the North
Mother Earth Healing Society
R. Lawrence

Environmental Resource Centre
Toxics Watch Society
Pembina Institute for Appropriate Development
Alberta Wilderness Association
Calgary Eco-Centre
Voice of Women - Edmonton Branch
Canadian Parks and Wilderness Society of Alberta
Alberta Coalition Forest Spray Alternatives
Canadian Society of Environmental Biologists
B. Stazinski
M. Kitagawa
R. Macintosh
R. Chant

Fort Assiniboine District Environmental Association
D. Breithkreitz

Spokesperson for herself and other young people
Ms. M. Rogers

Alberta Special Waste Services Association
T. D. Bosse

Town of Swan Hills
Mayor W. Peters

Swan Hills Liaison Committee
Ms. L. Dakin

Alberta Special Waste Management Corporation
Ms. I. Chanin

Environment Canada
F. Zaal

Natural Resources Conservation Board Staff
W. Y. Kennedy
P. Cleary
Ms. J. Ingram
M. Bruni (ERCB staff)

NATURAL RESOURCES CONSERVATION BOARD

APPLICATION #9101
EXPANSION OF THE ALBERTA SPECIAL WASTE TREATMENT CENTRE
REPORT ON 11 FEBRUARY 1992 MEETING AT SWAN HILLS

A meeting before the Board was held in Swan Hills on 11 February 1992 to hear a status report by the Indian Association of Alberta, and the Grouard, Sucker Creek, Swan River and Driftpile Indian Bands (the Indian Association of Alberta and these Bands are hereinafter collectively referred to as the "Indian Bands") respecting the progress of their intervention. Appearing at the meeting were Mr. Slavik for the Indian Bands, Mr. Wilde for Edmonton Friends of the North Environmental Society, and Mr. Saville for Chem-Security (Alberta) Ltd. (hereinafter referred to as "CSAL").

As a result of the meeting, the Board confirmed the resumption of the hearing at 9:00 a.m. in the Swan Hills Community Centre on 26 March 1992, with filing of the submission on behalf of the Indian Bands to be no later than 20 March 1992.

At the meeting the Indian Bands made a number of requests of the Board. The Board reserved decision with respect to the following matters:

1. That the Board direct the Alberta Special Waste Management Corporation (hereinafter referred to as "ASWMC") and the Joint Venture of the ASWMC and Bovar Inc. be joined with CSAL as applicant;

2. That the Board direct the Honourable Mr. Klein, Minister of the Environment, or a senior representative of his Department and further that Mr. Clark, Chairman, or some other member of the Board of the Alberta Special Waste Management Corporation, appear at the hearing to give evidence and answer questions; and,

3. That the Indian Bands receive an advance of funds in respect of costs to facilitate their participation in the hearing.

This report contains the Board's decisions with respect to the above matters. In reaching its decisions the Board had regard for the arguments put forth by the various participants at the meeting.

1. THE APPLICANT

The Board is satisfied that CSAL is making the application on behalf of the owners of the Centre, ASWMC and Bovar Inc., and that these parties are bound by any commitments or undertakings given by CSAL. Further, the Board is satisfied that the owners of the

Centre would be bound by any Board decision with respect to the applied for expansion of the Centre. For this reason the Board is not prepared to direct that the owners of the Centre be joined with CSAL as applicants.

2. THE APPEARANCE OF ADDITIONAL WITNESSES

The Board is not satisfied that the additional witnesses requested by Mr. Slavik for the Indian Bands are required to provide the information that is necessary to conduct a full review of the application for the incinerator expansion at the Treatment Centre. Therefore, the Board is not prepared to direct the Honourable Mr. Klein or a senior representative of his Department, or Mr. Clark or some other member of the Board of the ASWMC, to appear at the hearing to give evidence and answer questions.

3. ADVANCE OF FUNDS IN RESPECT OF COSTS

Mr. Slavik requested an advance of funds in respect of costs to assist with the continued participation of the Indian Bands in the hearing. The items covered by the requested advance and the estimated amounts are as follows:

a) $21,000.00 for expert technical assistance to review estimates of future volumes of waste available to the Centre and the methodology employed by both CSAL's and the Swan Hills Expansion Review Coalition's consultants in the preparation of their Waste Volume reports;

b) $9,000.00 for expert technical assistance to review and prepare a report regarding the proposed monitoring program for the planned expansion;

c) $30,000.00 for legal assistance; and,

d) $10,000.00 for "out of pocket" costs of members of the Indian Bands' Steering Committee to allow their involvement in the ongoing work and for attendance at the hearing.

CSAL accepted that the Indian Bands are eligible for a funding award in accordance with Section 10 of the Natural Resources Conservation Board Act.

With respect to the request for expert technical assistance, the Board notes that both waste volumes and monitoring were dealt with extensively in the evidence provided by CSAL, the intervention of the Swan Hills Expansion Review Coalition and in questioning at the hearing to date. Having this in mind, the Board is not convinced that funding should be provided for further in depth analysis of these matters as requested by the Indian Bands. However, the Board agrees that it would be desirable for some expert technical advice to be available to Counsel for the Indian Bands in order to review

the application and to prepare questions and argument for the hearing. The Board is prepared to recognize such assistance in the form of an advance of costs, but believes that the costs should be less than half of the $30,000.00 estimated by Mr. Slavik.

The Board is also prepared to recognize the cost of: (i) legal assistance, and (ii) out of pocket expenses for the attendance of the Steering Committee at the hearing and a reasonable number of organizational meetings in an advance award of costs. Such costs must be reasonable and required to assist the Indian Bands' in their participation in the hearing. The total estimate for these items put forth by Mr. Slavik was some $40,000.00. In the Board's opinion this estimate appears higher than the costs need be. The Board is prepared to include $25,000.00 in the advance of costs for these items.

In summary, the Board is prepared to make an advance of $40,000.00 to the Indian Bands. It will direct CSAL to provide these funds to Mr. Slavik's firm for disbursement on behalf of the Indian Bands. The advance is being made on the understanding that if the final cost award is less than the advance, the difference in the amount will be returned by Mr. Slavik to CSAL. The final cost award will be made by the Board following completion of the hearing on the basis of a cost application to be filed by the Indian Bands.

Issued by the Board
12 February 1992

G.J. DeSorcy - Chairman

G.A. Yarranton - Vice-Chairman

C.H. Weir - Member

APPENDIX E - Form of Approval

THE PROVINCE OF ALBERTA

NATURAL RESOURCES CONSERVATION BOARD ACT

NATURAL RESOURCES CONSERVATION BOARD

IN THE MATTER of a project of Chem-Security (Alberta) Ltd. for the expansion of the incinerator at the Alberta Special Waste Treatment Centre at Swan Hills

APPROVAL NO. 1

WHEREAS the Lieutenant Governor in Council, by O.C. 377/91, has prescribed that the proposed incinerator expansion at the Alberta Special Waste Treatment Centre at Swan Hills be a reviewable project under section 4(f) of the Natural Resources Conservation Board Act; and

WHEREAS the Natural Resources Conservation Board is prepared to grant the application by Chem-Security (Alberta) Ltd. for an incinerator expansion at the Alberta Special Waste Treatment Centre at Swan Hills, subject to the conditions herein contained, and the Lieutenant Governor in Council has given his authorization, hereto attached.

THEREFORE, the Natural Resources Conservation Board, pursuant to the Natural Resources Conservation Board Act, being chapter N-5.5 of the Revised Statutes of Alberta, 1980, hereby orders as follows:

1. The project of Chem-Security (Alberta) Ltd. (hereinafter called "the Operator") for an incinerator expansion at the Alberta Special Waste Treatment Centre at Swan Hills, as such project is described in Application No. 9101 from the Operator to the Board dated 15 July 1991, and descriptive material supporting the application marked as exhibits at the hearing by the Board from 25 to 28 November 1991, and 27 January 1992, and 26 to 28 March 1992, is approved, subject to the terms and conditions herein contained.

2. The Operator shall not incinerate any waste material which is significantly outside the range of composition of that being incinerated at the existing facility unless it has first conducted

test burns, re-assessed probable emissions and their potential effects, discussed the results with Alberta Environment and made any changes to protocols for sampling and analysis, equipment and treatment processes that Alberta Environment may require.

3. The Operator shall not incinerate any material from wood preserving plants that is contaminated by pentachlorophenols (PCPs) unless it has conducted one or more test burns and assessed probable emissions and their potential effects, discussed the results with Alberta Environment and made any changes to protocols for sampling and analysis, equipment and treatment processes that Alberta Environment may require.

4. The Operator shall monitor the polychlorinated biphenyl (PCB) content in waste delivered to the Centre, and if waste containing PCBs returns to volumes or concentrations similar to those encountered in previous years, the operator shall re-assess possible PCB emissions and the consequent risks to human health and the environment, discuss the results with Alberta Environment and make any changes to equipment and treatment processes that Alberta Environment may require.

5. The Operator shall not install a heat recovery system on the new incinerator unless it has satisfied Alberta Environment that the operation of the Centre, including the heat recovery system, will continue to meet licensed emission limits.

6. The Operator shall comply with the permits and licences of the Clean Water Act and the Clean Air Act or any subsequent amendments thereof issued by Alberta Environment, and with all other applicable regulations and standards of the Province of Alberta.

MADE at the City of Calgary, in the Province of Alberta, this __ day of _____, 1992.

NATURAL RESOURCES CONSERVATION BOARD

APPENDIX F - Summary of Recommendations

Throughout this report, the Board has included a number of recommendations and suggestions regarding future operations of the Special Waste Treatment Centre. Most of these are intended for Chem-Security as the operator of the Centre and Alberta Environment as the regulator of operations at the Centre. The following is a summary of those recommendations.

Related to the Origin of Special Wastes

- In order to encourage waste minimization, the Board recommends that the Government of Alberta document to a greater extent, and communicate more extensively to the public, its ongoing plans in this regard.

- The Board assumes that any change to the Government's waste importation policy would occur only after public consultation and an assessment of the advantages and disadvantages to Albertans. It recommends that any such assessment include consideration of the issues dealt with in this report and the effects on those issues that would result from a change of policy.

Related to Operational Procedures

- If loads of waste arrive at the Treatment Centre that are sufficiently heterogeneous that single core samples are inadequate to characterize them, or are frozen or otherwise difficult to sample, the Board recommends that Chem-Security develop, and Alberta Environment review, a protocol for sampling them before treatment begins.

- The Board recommends that Chem-Security and Alberta Environment develop a protocol limit or series of limits to be applied to the concentrations of heavy metals in the material to be incinerated.

- The Board recommends that Chem-Security and Alberta Environment jointly review the causes of process excursions and the actions taken by operators in response to each event to determine whether operational procedures can be improved to limit the number and duration of emergency venting episodes in the future.

- The Board recommends that Chem-Security further investigate the technical and economic feasibility of some form of pollution control that could be applied to gases vented from the proposed incinerator expansion during an emergency, and review its conclusions with Alberta Environment by December 31, 1992, with the objective of ensuring that the best practical technology is being applied.

- The Board recommends that Chem-Security carry out its intention, expressed at the hearing, to employ dust control measures when dust is being generated at the Centre.

- Because the phenomenon of the formation of organometallic compounds in pollution control trains and their emission from stacks, if it occurs, is not likely to be confined to the Treatment Centre, the Board recommends that Chem-Security consult with other operators of waste incinerators with the objective of sponsoring a joint investigation of the matter and how it might be controlled.

- If Chem-Security has difficulty in meeting the new emission licensed limit for dioxins and furans, or if long-term monitoring results show that their concentrations in environmental components are increasing unacceptably, the Board recommends that, Chem-Security, with the advice of Alberta Environment, initiate an experimental program to improve control of the emissions.

- With respect to deep-well disposal, the Board recommends that the Energy Resources Conservation Board and Alberta Environment maintain their careful surveillance of the operation of the disposal well because of the long-term contamination of potable aquifers that could occur if it fails to operate as designed.

Related to Monitoring and to Modelling of Concentrations of Contaminants in the Air

- The Board recommends that when reviewing and modifying the design of monitoring programs, Alberta Environment and Chem-Security take into account:

  - the potential need to pay more attention to contaminants that may be emitted in small quantities but which may accumulate in the environment; and

  - the effect of building downwash.

- Except when monitoring is being undertaken for special purposes such as test burns related to changes in feedstock, the Board recommends that the sampling of emissions and ambient air for contaminants present in low concentrations be timed to occur during typical operations.

- The Board recommends that Chem-Security conduct a further examination of the sensitivity of its modified ISCST model output to mixing height and, in particular, what the effect of using the mixing height data available for Stony Plain would be on predicted ground-level contaminant concentrations. The results of the examination should be reported to Alberta Environment for consideration in the licensing of the expansion and with particular reference to the height of the stack.

Related to Public and Occupational Health

- If there are significant changes in the composition of the waste stream treated at the Centre, the Board recommends that Chem-Security review the potential effects of

those changes with Alberta Occupational Health and Safety and make any revisions that may be required to its programs to protect the health of workers at the Centre.

- The Board recommends that Chem-Security meet with the Sturgeon Health Unit to review its epidemiological data annually, or less frequently should the Health Unit consider that adequate.

- With respect to the possibility of exposure of workers to relatively high concentrations of contaminants during process excursions, the Board recommends that Chem-Security consider the possibility of requiring workers not otherwise required to wear breathing masks to have immediate access to such equipment for use during emergency venting episodes.

- With respect to accidental spills and releases, the Board recommends that the results of Chem-Security's consequence analysis be discussed with Alberta Occupational Health and Safety and Alberta Environment so that those departments may require any appropriate action to further reduce risks.

Related to Social Effects and Communication with the Public

- With respect to the employment effects of the construction and long-term operations, the Board encourages Chem-Security to continue to upgrade its training program to allow full participation by the local and regional population, including aboriginals, in any employment opportunities resulting from an expanded Centre.

- The Board recommends that efforts be made to ensure that all interested members of the public have an opportunity to appropriately participate in the ongoing public involvement programs.

Related to the Eventual Closure of the Treatment Centre

- With respect to the landfill area, the Board recommends that upon closure, the site be permanently marked and recorded in the appropriate land record offices. Also, the vegetation cover should be limited to shallow-rooted species in the initial planting and through subsequent care, so as to prevent possible penetration of the protective liner by root action.

- The Board recommends that Alberta Environment, as regulator of the Centre, require the exercise of appropriate care in operations, adequate monitoring, and sufficient reporting to ensure that the eventual proper cleanup of the site will not be a technically difficult nor excessively costly operation.

Related to the Periodic Licence Review

- During the periodic reviews, the Board recommends that Chem-Security and Alberta Environment should examine:

  (i) reports of the design and operating performance of other similar facilities in other countries;

  (ii) changes in regulatory standards and requirements in other jurisdictions;

  (iii) the performance of the proposed expanded Centre at Swan Hills, including the composition of feedstock, the results of monitoring its emissions, and the results of monitoring contaminant concentrations in people and in the environment;

  (iv) information on the PCB content of feedstock, the progress in implementing remedial measures to control fugitive emissions and the results of the PCB monitoring programs, in order to determine the effectiveness of those remedial measures and any need for further improvement;

  (v) analytical data on the quality of drinking water downstream of the Treatment Centre and the adequacy of the sampling protocols used to obtain them;

  (vi) any cases where Chem-Security has detected statistically significant increases in the concentration of any contaminant in any environmental component over a period of 3 or more years; and

  (vii) the concentrations of tributyl phosphate in aquatic sediments and groundwater.